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A Weekly Review of Current Progress in Electricity

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Vol. VII. NEW YORK, FEBRUARY 27, 1886. No. 9.

THIS week our columns contain a number of articles bearing on points raised at the recent meeting of the National Electric Light Association and on electric light matters in general. They will all be found of value and significance.

MR. GARLAND is again said to be anxious to dispose of his Pan Electric stock, by giving it to a charitable institution, but Dr. J. Harris Rogers threatens an injunction should he do anything of the kind. The newspapers are still full, in fact, of rumors in regard to Mr. Garland's intentions respecting his stock and his Cabinet seat, but next to nothing is known by any of the writers.

OUR description of the Blackpool electric railway proves conclusively the great advantage of electric over cable railways for city traffic. With the conductor laid in a trench, with narrow groove for contact, there can be no possible objection on the score of danger; and with an overhead sliding conductor trouble can also be avoided. The developments of the last few months, indeed, show unmistakably that the electric railway is the one *par excellence* for city traffic, and the number of such roads now in course of projection or operation will soon be greatly increased.

WE are glad to learn that in affirming the legality of the $3-per-month telephone law the Supreme Court of Indiana showed itself of opinion that the law is neither just nor expedient. This sensible view of the case is shared by many of the best men in Indiana, and it is to be hoped that ere long the State may get rid of such an outrageous piece of legislation. Cheering news comes from Iowa that a committee of the Legislature there has reported, recommending indefinite postponement of the bill regulating rates after the foolish Indiana fashion.

IN another column Mr. Rich. N. Dyer defends Mr. Edison against the accusation of those who aver that the latter is not the inventor of the incandescent lamp. He seeks to show that the carbon filament of high resistance did not alone constitute the full invention, but that all the points which go to make up a successful incandescent lamp must be included in forming an estimate of the invention and its scope. Mr. Dyer's argument is ingenious, but, as we have often said before, we refrain from sitting as judges upon this great question, with which the courts are now grappling. We shall, however, leave our columns open for any discussion of the subject.

IN his admirable recent paper Prof. Hughes draws attention to the difference in the resistance of telegraph lines during the variable and stable periods of the current, *i. e.*, at the time that the current rises from zero to its full strength. He shows that an iron telegraph wire has with rapid currents *more than three times the resistance* during its actual work than that supposed to be its true resistance. Copper shows far less of this property, and hence its advantages for rapid telegraphy and for telephony are manifest. Numerous other interesting and valuable properties of conductors are also described, and Prof. Hughes' experiments seem to settle the long debated question of the best form of lightning conductor, which, as he shows, should consist of a flat ribbon or strip of copper; the solid iron rod often employed being in fact the worst possible form.

THE papers read at the late convention in Baltimore on the electrical transmission of power brought out with great force the probable future of electric light stations. We believe it to be sufficiently demonstrated by actual experience that the earning capacity of a dynamo is second to that of no other machine, without a single exception. In the near future every dynamo plant will be a lighting station at night and a power station during the daytime, and thus we shall have as an accomplished fact an ideal long cherished. Our electric light men having had their eyes opened to the promising field before them may be depended upon to grasp the opportunity offered, and the work to be accomplished here could certainly not be left in better hands than theirs, if they will lose no time in dealing with it. We speak of what we know when we say that there is very active and successful work being done in the improvement and use of electro motors to-day, with every promise of better results in the near future.

THE rivalry existing among English dynamo makers may shortly lead to a competitive test of the machines of different makers, one firm having already signified its willingness to contribute to the expense of such an undertaking. It may perhaps be doubted whether in the light of past experience the results of such tests carry with them the weight which they should. To the scientific mind the high efficiency obtained by some dynamos is most gratifying, but does the actual consumer, the intending purchaser of a dynamo, view the thing in the same light? Most assuredly not, for it would be rash to deny that as many dynamos are sold which are unstamped with the seal of high efficiency, as of those which are. And this will always be so. The general public will continue to be guided more by questions of temporary expedience than by the result of close calculation. Again the refusal, for whatever reason, of a dynamo builder to enter such a competitive test, ought not to be taken as a ground for suspecting weakness, yet unless such a competition is universal it hardly affords a just criterion for comparison. Our own opinion regarding these competitive tests is that while from a scientific standpoint they are most desirable and of value, they fall far short of their intended purpose, and rather beget feelings of envy than of emulation.

AT the recent Electric Light Convention, Mr. Rorison, of Indianapolis, raised the question of the commercial efficiency of incandescent lamps. He could hardly have hit upon a more perplexing one, as although numerous experiments have been made and certain laws deduced, no definite state has been arrived at in this matter as yet. There are four variables which enter into the question of the commercial efficiency of an incandescent lamp, and they are: Electromotive force, resistance, candle-power and life. The problem to be solved evidently consists in establishing a relationship between any two or more of these variables, to which finally the cost of the lamp itself may be referred, and from these deducing the most economical conditions under which the lamp can be run. For instance, we might employ a high-resistance lamp, and by running it below its standard E. M. F., prolong its life indefinitely. But this diminution of E. M. F. means naturally a reduction of candle-power, so that a gain on one hand is obtained at a loss on another. If we assume certain fixed conditions in the above variables based upon trials, we can, however, easily calculate the relative commercial efficiencies of lamps under the different conditions assumed, and can compare lamps of different makers in the same way. The latest useful information on the subject is in reality that furnished by the Franklin Institute lamp tests.

OUR report last week of the meeting of the National Electric Light Association, with the various papers presented—occupying in all nearly nine pages of the issue in solid type—served to give a good idea of the importance of many of the questions now pressing for settlement at the hands of electric lighting men. In some quarters it seems to be thought well to have out at once the various fights between parent and sub companies, or between rival companies representing different systems in the same place. Troubles will and must arise as business develops, but it is not improbable that were development made the great end, the best grounds of agreement and mutual concession being sought meantime, many of the difficulties would cease to make themselves felt. The work of what may be called the Committee of Conciliation will be watched by all with great interest. How far competition can be healthfully and legitimately restricted, it is as hard to determine in electric lighting as in any other field, but the meeting made it evident that some efforts are likely to be put forth sooner or later of a protective nature. The questions as to the relative merits of high speed and low speed engines, the use of incandescent lights on arc circuits, the utilization of station reserve power for electro-motors, and others of equal import, are not likely to be answered at once, but will find their solution as well in scientific advance as in the practical results obtained by those who have to run the stations. The activity of mind, and the evident desire for closer union and more harmonious relations, on the part of all engaged in the business, are the best guarantees that could be given for the early realization of promise and expectation in this great and growing department of electricity.

PROF. HUGHES, in taking the chair as President of the Society of Telegraph Engineers and Electricians, read a paper which, for the simplicity and brilliancy of the results which it contains is, in our opinion, second only to the papers of the great Faraday himself. We give in this issue the first part of the address, of which Prof. Hughes has kindly forwarded us the advance proofs, and we draw special attention to the paper, as it cannot fail to have a most important effect upon many forms of electrical apparatus now in use. Prof. Hughes shows that the force and duration of the extra currents depend upon the *kind of metal* employed as a conductor, its *molecular condition* and the *form* given to the conductor, and is *independent of its resistance or the electromotive force of the primary current*. These facts being very contrary to the generally accepted ideas on this subject, cannot fail to arouse the most profound interest. Among the results obtained by Prof. Hughes is the remarkable one that for equal lengths of wire 1 mm. in diameter, the E. M. F. of the extra current is six times greater in iron than in copper, and that carbon is the lowest one of the materials compared, giving only one-hundredth as much as iron. This proves the adaptability of carbon as a variable resistance in electric circuits. These investigations would also point to the fact that the material of construction in various electrical apparatus will be changed from copper to iron, and *vice versa*, according to the purpose for which they are intended. Prof. Hughes shows, too, that the self-induction in copper is far more influenced or reduced by an external wire than in iron. The practical telephone man will here recognize immediately the reason of one of the benefits in the use of copper wire. Prof. Hughes has not stopped here, however, but, continuing his experiments, he shows that the form of the conductor has a most marked influence on the extra current induced. He proves that a conductor in the shape of a ribbon or strand has far less self-inductive capacity than a solid one of the same weight; and in one case iron wires in the form of a strand gave 88 per cent. less effect than a solid wire of equal weight. Copper conductors showed also a marked reduction when similarly treated, but not so great a reduction as was observed in iron. He proves again, that by separating the contiguous portions of the same current from each other, the self-inductive effects are greatly reduced. In the construction of dynamo machines this fact will have a most important bearing, for by employing a suitable form of wire much of the sparking at the commutator, due to the self-induction of both armature and field magnets, can be obviated. The form of the future telegraph line may also be changed in accordance with these investigations. Taken as a whole, Prof. Hughes' latest discoveries must take rank as among the most original and important of recent times. Indeed they are of such a novel and unexpected character, that had they come from any one of less authority than Prof. Hughes, they would be looked upon with suspicion. But originating, as they do, with a careful and accurate investigator, they will carry with them the weight of acknowledged authority. As we have stated before, the effects of these experiments will undoubtedly manifest themselves in many beneficial ways, and the thanks of the whole electrical community are due to Prof. Hughes for his valuable and disinterested labors.

Magnetic Screens.

BY PROF. W. A. ANTHONY.

The statement often met with that masses of soft iron will screen a magnet or other body from the effects of external magnetism seems not to be well understood. The effect is best explained by studying the "lines of force" by means of which Faraday so clearly expressed the effects of the magnetic field. The directions of these lines may be well shown by sprinkling iron filings on a piece of glass laid over a magnet. The curves so obtained are represented in Fig. 1.

But the intensity as well as the direction of the forces in the magnetic field may be indicated by so drawing the lines that the number passing through unit area at any place shall be equal to the intensity of the field at that place, as indicated.

Where lines are close together the force is strong; where they are far apart the force is weak. In one respect, however, this diagram, which is similar to those generally given in the text books, is faulty. No line of force really ends in the space around the magnet, but is continuous from pole to pole, and, since the lines may be considered as returning to their starting points through the bar, each is a closed curve extending from the north to the south pole through the magnetic field and back to the north pole through the magnet.

It is well known that a wire carrying an electric current exhibits magnetic force. The lines of force around such a wire are circles whose centres are on the wire, and whose planes are perpendicular to it. Let the wire be wound into a helix, and these circular lines surrounding the individual spires combine to produce lines of force exactly similar to those of a bar magnet, and the helix *is* a magnet, possessing all the properties of a magnetized bar. If a bar of soft iron be put into the helix the magnetic force is greatly increased; or, in other words, the lines of force become more numerous. This is usually explained by saying that the bar is magnetized by the current and adds its force to that of the helix. But there

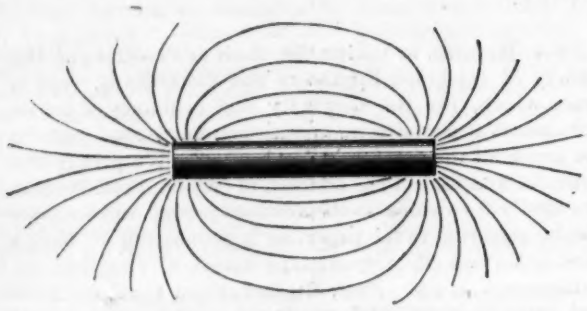


FIG. 1.—MAGNETIC CURVES.

is another way of viewing this magnetic effect of the helix, that aids greatly in understanding certain magnetic phenomena. The tendency of the helix to develop magnetic lines may be called "magneto-motive force," and compared to the E. M. F. of a voltaic cell. The material in the space within and around the helix may be considered as offering more or less resistance to the formation of magnetic lines, and the number of lines formed in any case will depend upon the relation that the magneto-motive force bears to this resistance, just as the electric current produced in a given case depends upon the relation of the E M. F. of the generator to the resistance of the circuit. Upon this view, the increased effect when iron is placed in the helix is due to the fact that iron is a far better conductor of magnetic lines than air.

Let us apply this idea to the study of the screening effect of masses of soft iron. Suppose a soft iron ring, Fig. 2, to be placed in a magnetic field. In consequence of its high conductivity the lines of force entering it on one side will follow round the ring and escape from it on the opposite side, leaving the interior almost devoid of magnetic force. But, if a plate of iron be similarly placed in a magnetic field, so far from screening the space beyond it, it will, unless it is very large, rather increase the strength of the field. Fig. 2 represents approximately the appearance of the lines of force in these two cases.

It is, therefore, not sufficient to interpose a mass of iron, unless a very large one, between a magnet and the body to be screened from its effects. To be effectual, the screen must completely surround the body, or else surround the magnet. The writer has recently tested a device for shielding watches from the effects of a magnetic field, in which this principle is applied. The shield consists of a little sheet iron pan in which the works are placed and covered with a sheet iron disc placed under the dial. It proved a perfect protection when the watch was placed edgewise within three-fourths of an inch of a large and very powerful electro-magnet. When the watch was back toward the magnet the protection was not so perfect, but was effectual in a magnetic field to which the watch would not be likely to be exposed by being worn around a dynamo.

Some familiar magnetic phenomena appear in a clearer light when the office of masses of iron is considered to be that of conductors of magnetic lines of force. For instance, when an armature is applied to a horse-shoe magnet, a good conductor of magnetic lines is substituted for the air, a poor conductor, through which the lines, comparatively few in number, go straying round from pole to pole. The result is that, if the armature is massive enough, nearly all the lines go through it and the external field almost entirely disappears. A good analogy would be found in a voltaic battery submerged in a poorly conducting liquid. The electric current would go from pole to pole, spreading out through the liquid something as the lines of force go through the air from pole to pole of a magnet. But, if the poles of the battery be joined by a thick copper wire, the current will flow through it, and will almost disappear from the liquid. Besides this the total current is largely increased when the copper wire connects the poles, and in like manner the magnetic lines are increased when iron is substituted for air in the magnetic circuit.

In the dynamo machine it is the office of the field magnets to develop a field in which the armature is to revolve. The masses of iron in the field magnets and

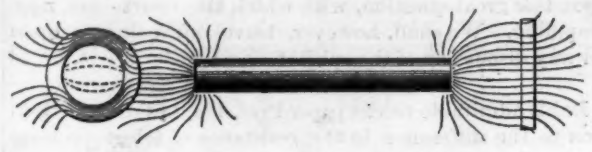


FIG. 2.—RING IN MAGNETIC FIELD.

armature should be so proportioned and so placed, that the lines of force going from pole to pole shall, as far as possible, go through the armature, and not through the air outside. Magnetism outside the machine is magnetism wasted, and any considerable outside field is evidence of faulty construction. Such a defect is often due to too little iron in the armature, or too small or too long a connecting piece between the parts of the field magnet, or sharp points or angles about the pole pieces.

PHYSICAL LABORATORY, CORNELL UNIVERSITY.

Electric Signaling from Balloons.

By direction of the English War Office, further experiments in army signaling of a novel and interesting character have been begun at the Army Signaling School, Aldershot, under the superintendence of Major Thrupp. Mr, Bruce, son of Major-Gen. Bruce, attended to exhibit his balloon signaling apparatus. The balloon holds between 4,000 and 5,000 feet of gas. The interior is illuminated by six incandescent lamps of about 15 candles each, which can be increased up to 100 if necessary. A 25-cell battery was used, and the signaling was carried on by means of a key similar to that used on telegraph instruments, which charged the lamps for short and long periods. The balloon, which was made captive to a stake driven in the ground, ascended about 500 ft., and a party of signalers having been sent out some miles away from the camp, several messages were sent and read by the signalers and replied to by the limelight, under very unfavorable atmospherical conditions, it being very foggy and snow falling the whole time. The light was also tried outside the balloon. It is understood that further experiments with this system will be carried out.

Two New Electric Light Switches.

No branch of electrical work shows more plainly the changed conditions of the last few years than that which is concerned in the measurement and manipulation of currents. Formerly all apparatus employed for the purpose

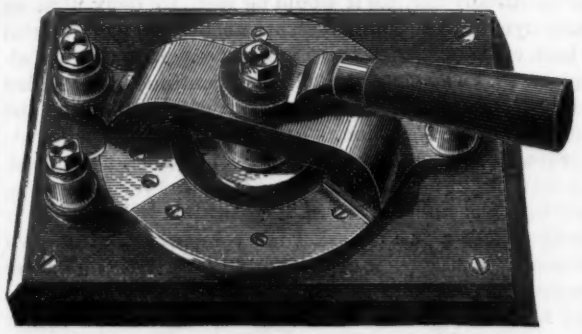


FIG. 1,—WOODHOUSE & RAWSON S NEW SWITCH.

was constructed on the same lines as optical and philosophic instruments, and could only be intrusted in careful hands trained to their use. But now the man who drives the engine of an electric light installation must usually measure the current, and be able to direct it into the required circuits and vary the conditions at will. Hence all the appliances have been altered to suit this rougher character, and while retaining their original accuracy of construction, and displaying tenfold their former ingenuity, they have a strength and simplicity never sought for before. Part of the change is also due to the greatly increased currents now employed, which would rapidly destroy the small surfaces and imperfect contacts which suffice for telegraphic purposes.

Messrs. Woodhouse & Rawson have recently brought out two ingenious forms of switches, which are shown in the accompanying illustrations, for which we are indebted to *Engineering*. The smaller, Fig. 1, which is intended for general purposes, and will carry 60, 100, 200, or 500 amperes, according to its size, has three terminals. The current entering at that to the right of the figure can be directed to either of the circuits connected to the left-hand terminals, or to both at once, if the handle be placed in the mid-position. The bridge which forms the connection between the two sets of terminals is mounted upon a central stud, about which it can be rotated by the handle. It is formed of a large number of strips of brass laid side by side, and bent to the form shown. Each strip, by virtue of its elasticity, takes a good bearing upon the contact plates, and thus an abundant surface is provided for the passage of the current so long as the bridge remains in its working position. By rotating it about 70 degrees, it can be transferred to the vulcanite strips which complete the circle between the contact plates; under these circumstances the circuit is broken.

The larger switch, shown in Fig. 2, is designed for regulating the number of accumulators in a circuit, and consists of a series of terminals with contact plates, arranged in a circle, a piece of vulcanite being interposed between each pair of metal plates. There are two bridges, similar to that already described, arranged side by side, and of such a width that neither ever touches two adjoining contact plates at the same time. These two bridges are insulated from each other, with the exception that there is a connection made through a resistance coil. The object of the arrangement is to prevent the cell between any two adjacent terminals from being short-circuited every time the arm passes from one to the other. As the switch is moved the main circuit is never broken, while at the same

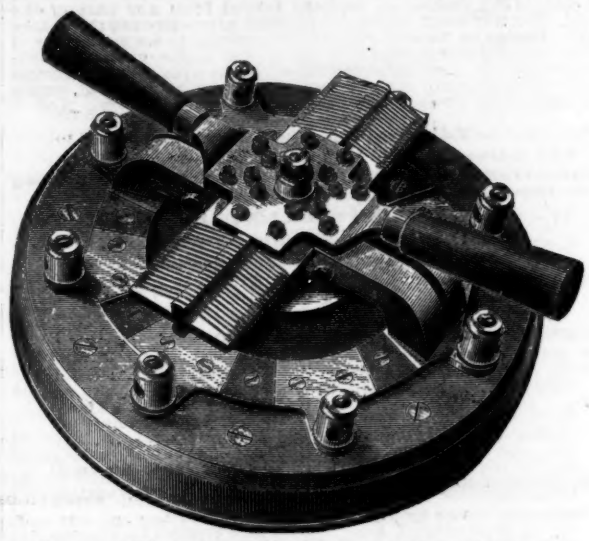


FIG. 2.—WOODHOUSE & RAWSON'S NEW SWITCH.

time the very injurious effect of allowing the cells to give off their charge at an abnormal rate is completely avoided.

Isolated Domestic Electric Lighting with Small Engines.

BY HOWARD RINEK.

On reading THE ELECTRICAL WORLD for January 30th, I noticed in the city correspondence a short account of the Shipman steam engine being used for domestic lighting, and as I have employed the same engine for a year to run a dynamo, I have reason to think that an account of my plant would be of interest to many who would like to be similarly situated.

My residence stands on a high bluff overlooking the Delaware River, Easton, Pa., and while building in 1882, I was puzzled considerably as to the manner of lighting my house. I did not care to purchase a gas machine, and as to getting gas from a local company that wanted to charge for the gas condensed in six hundred feet of pipe in addition to what I would use, that was out of the question.

A visit to the Electrical Exhibition, held at Philadelphia, enlarged my views as to the manner of lighting, and I felt certain that, with a satisfactory motive power, I could easily solve the question.

Several months after, I heard about the Shipman engine, and through correspondence with the parties, I learned that they had already successfully used one of their engines to run a dynamo. The correspondence ended by my giving the order for a two horse-power engine and one of the United States Co.'s thirty-light dynamos. I was much pleased with the looks of this make of dynamo at the Electrical Exhibition, and have never had any reason for regretting my selection, as it requires no attention beyond keeping clean its various parts. This company wired the whole house very satisfactorily, concealing all the wires, and arranging the "electroliers" in the main rooms with switches on the side walls, so that the lights belonging to the electroliers can be controlled without touching the lamps.

As you are probably aware, the engine is a steam engine using a cheap grade of kerosene for fuel. While running, the fire is at all times under control of an ingenious piece of mechanism called a diaphragm, which regulates or governs the amount of steam supplied to the atomizer, so that any amount of steam needed can be carried without variation in pressure. The plant is placed in a stone

building standing about thirty-five feet from the house, and measuring inside ten by fourteen feet. Both the engine and dynamo stand on bases built of brick, the fly-wheel of the engine being belted direct to the pulley of dynamo. The plant has been in continuous operation since December, 1884, and has given me great satisfaction and pleasure.

The engine is of sufficient power to run fifteen full candle-power lights, although seven lights are sufficient for ordinary use, and this number of lights can be had on forty pounds of steam. The lights are very steady, and occasionally when a slight wavering is noticeable, it can usually be traced to the belt. So far as my experience goes, the engine has proven itself to be perfectly safe, and it requires, after it is once started, little or no attention.

The plant is in charge of a boy of fourteen years, who cleans both the engine and dynamo every morning, and prepares them for running at evening. At dusk he starts the engine (which usually takes about fifteen minutes), sees that everything is working properly, and then goes home. At bed-time, when it is desirable to put out the lights, I simply push an electric button placed beside the bed, and in a few minutes the lights are out. This is accomplished in a simple manner. The two atomizer levers, which regulate the flow of steam, are connected together by a piece of heavy wire bent to an angle. Back of this rod stands an upright frame, having on top an ordinary magnet with a catch at the end of the armature; this catch holds a weight suspended from the frame, and when the circuit is closed the weight is released, and in falling it throws down the rod, putting out the fire. During the past year, I have added considerably to the various details of the plant, an account of which I am afraid would be tiresome to your readers; and as I have already taken up too much of your space, I simply desire to say, in conclusion, that those who have used the incandescent light in their homes will never again be satisfied with gas.

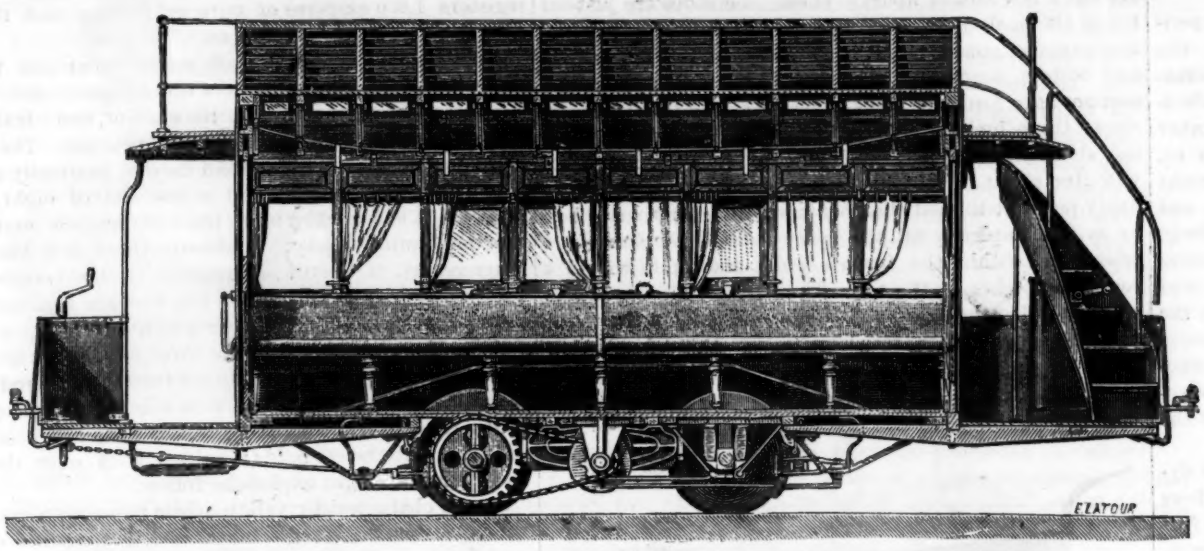


FIG. 1. BLACKPOOL ELECTRIC TRAMWAY.

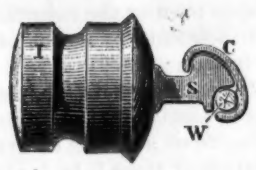


FIG. 2.

The Blackpool Electric Tramway.

The successful installation of this road, recently put in operation, has aroused considerable attention in England, and it constitutes the third road now in use there. The first, the Portrush, nearly six miles in length, has now been steadily worked for more than two years, and has proved itself reliable in every respect. At Brighton, England, Mr. Magnus Volk has been operating an electric road for some time and with eminent success. On the Blackpool road every means has been taken to reduce the objections of electric lines in cities to a minimum, as will be seen by our illustration, Fig. 3, which represents a part section of the road-way in perspective. The entire electrical part of the road is below the surface of the street, and the rails are not used as a conductor. The latter consists of two copper tubes of elliptical shape, and having a wide slot for facility of attachment to iron studs, which are supported in porcelain insulators. The latter themselves are attached to blocks of creosoted wood in the sides of the channel. The tubes are fixed to the studs by the simple device of a wooden pin wedge, and they are coupled to each other by two metallic wedges, as shown in our illustration, Fig. 2.

The car which is employed is shown in longitudinal section and in plan in Figs. 1 and 4, which are so clear that no extended description appears to be necessary.

At each end of the car there is a switch-box with resistance coils placed under the platforms, by which means the strength of the current and speed of car can be regulated. To reverse the direction in which the car is traveling, the direction of the current through the armature is reversed, the field magnets, which are shunt-wound, remaining always magnetized in the same sense. With this arrangement there is no need to alter the position of the brushes, which in this case consist of two parallel sets of plates placed tangentially to the commutator, and pressed on it by spiral springs. There is only one handle to the two switch-boxes, and that being in possession of the driver, the possibility of accidents caused by interference of others with the electrical connections is precluded. The current is generated by four-pole Elwell-Parker dynamos, and the motors are also manufactured by that firm.

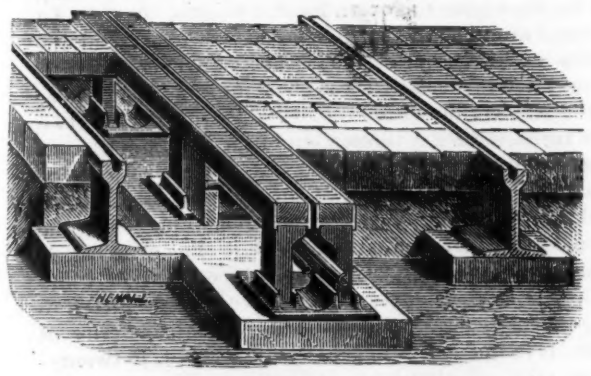
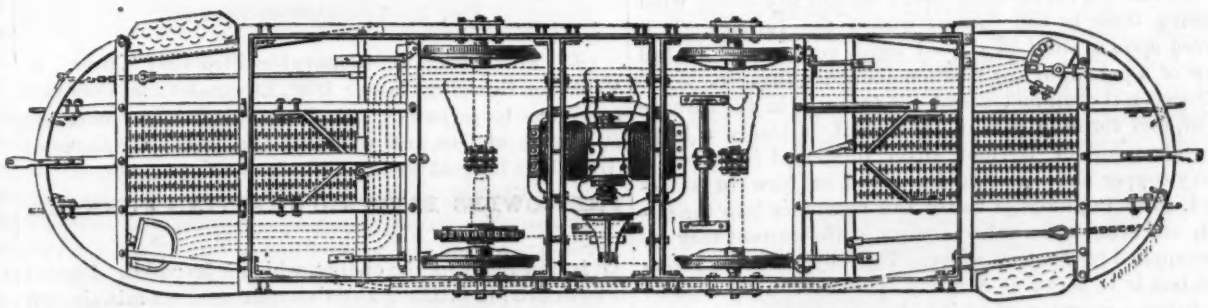


FIG. 3.



BLACKPOOL ELECTRIC TRAMWAY.

FIG. 4.

Enlargement of the Thomson-Houston Factory at Lynn, Mass.

The extensive electrical manufacturing establishment of the Thomson-Houston Electric Company is one of the most imposing and attractive buildings in Lynn, and one of the best equipped factories of the kind in this country or abroad.

The factory as it now stands is in the form of an L, with a frontage of 110 feet and running back 120 feet, the width of each wing being 55 feet. The entire building, with the exception of the engine and boiler-house, is four stories in height, and each floor receives abundance of light through numerous high and broad windows. The two-story building containing the engine and boilers lies back a short distance from the factory, and occupies part of the area at right angles with the two wings. The entire establishment is completely supplied with the most highly improved machinery, and each of the many departments is systematically devoted to some particular kind of work, under the supervision of a skilled electrician. At present 400 hands are employed. A comprehensive idea of the Lynn factory as it now is can be had by the reader by a glance at page ii. of this paper.

More than a year ago the company began to realize the rapid growth of its operations, and the steadily increasing demand for its dynamos and its other electrical apparatus, and it soon became cognizant of the fact that the factory must be enlarged and facilities for manufacturing be increased.

The ground has already been broken for the foundation of the new addition to the factory. The new building will be ⌋ shaped, and will adjoin the other, having a frontage of 63 feet and running back 140 feet. Similar to the older building, it will be four stories in height, but it will differ from the former in its more artistic style of architecture. The new premises will give the company nearly double the working room formerly had, which will not only largely increase the facilities for manufacturing arc-light apparatus, but will afford accommodations for pushing the new incandescent branch of the company's business.

The Thomson-Houston Electric Company intends to manufacture hereafter everything connected with incandescent lighting—dynamos for from 15 lights to 500 lights, and even for a higher number of lights if so ordered, and lamps from 10 candle-power to 125 candle-power. This important adjunct to the company's business will prove, it is thought, an important factor in its prosperity and influence. The new building will be finished about the 1st of next August. The employés will be increased, so that the entire force will number between six and seven hundred people.

An additional engine and boiler plant is to be installed on the premises, including a new engine of 200 horse-power. Necessary arrangements will be made for increasing the power of the plant at short notice to meet the demand when it arises. Great care will be brought to bear in the selection of the equipment for the new building, and most of it will be manufactured expressly for the company, and will embrace many highly improved machines of foreign and domestic make. The company has recently added several new features to the incandescent dynamo it now manufactures, which greatly enhance its beauty and efficiency.

The "Volta Pavia" Battery.

In a recent interview Mr. Goldner stated that the battery which we have already mentioned in previous issues, and particularly last week, has at last given out after lighting an 8 c.-p. lamp 8¼ hours a day for a total of 42 days, or 349 hours. The batteries which are now lighting the same lamp are of the improved form just perfected by the Chemical Electric Light and Power Company, the internal resistance of which is $\frac{5}{100}$ of an ohm, with an E. M. F. of $2\frac{3}{10}$ volts. The company has received orders to fit up at once both elevators of the Mutual Life Building, Boston, with one 8 c.-p. lamp each, and also a 16 c.-p. lamp in each one of the engine rooms. The whole plant will be in operation by the first of next week. There will consequently be two 8 c.-p. lamps and two 16 c.-p. lamps running at the same time from one individual set of batteries. The reason why the above-mentioned company is able to run lamps of different candle-power all at once economically and without inserting artificial resistances or the like, is that the generator employed is composed of a series of small generators which can be connected up so as to be controlled individually. Therefore, says Mr. Goldner, if a person has in his house only a few lamps and wishes to increase his plant capacity, it is simply necessary to add a few cells to those he has already. The batteries require little attention and can be put in any place, as they are not subject to the variations of temperature, and being economical in their way make it at once possible and practical to have incandescent lamps in dwelling houses, in passenger cars and in places where only a limited amount of electricity is required and where a dynamo could not be used to advantage, either on account of its high first cost or on account of a lack of facilities for such an installation. The company will soon be ready to put on the market their double circuit cell, which without increasing the size of the present one will give very nearly double the amount of ampère hours and consequently en-

able the company to nearly double the number of lamps. Mr. Goldner says that the accomplishment of 350 hours of light from a single solution of a primary battery has never before been recorded. In a private dwelling it would equal 5 hours of light for 70 days, and would reduce the cost below the former expectation of his company.

The Production of Aluminum and its Alloys in the Electric Furnace.*

BY EUGENE H. COWLES.

In order that I may give you as brief and explicit an explanation as possible of our discovery, process and inventions, I will first proceed with a description of the plant of the Cowles Electric Smelting and Aluminum Company, now in operation at the works of the Brush Electric Company, at Cleveland, O.

The apparatus used by us for the purpose of experiment in the reduction of refractory ores for the production of metallic calcium, magnesium, potassium, sodium, silicon, titanium, and the manufacture of aluminum and aluminum-bronze and other alloys, consists of two large Brush dynamos, two resistance boxes and two ammeters, a drying-pan, eight fire-brick furnaces, suitable electrical conductors and switches, hoods for carrying off vapor and gases, large carbons—3 × 30 inches—for electrodes, screens for sizing charcoal and carbon, and a large mortar and pestle, and several washing vats for washing and concentrating the furnace products. Steam-power to drive the dynamos is furnished by the Brush Electric Company. The arrangement of the plant so as to effect the reduction of the above-named metals and metaloids, by means of carbon as the sole reagent, is as follows:

The Dynamos.—These are, of course, placed in the dynamo room as near as possible to the driving shaft, where they can be kept free from any dust or grit from the furnace-room. The larger of these is by far the most powerful machine ever built by the Brush Electric Company. It weighs over 7,000 pounds, and at a speed of 907 revolutions per minute produces a current of 1,575 ampères with an intensity of 46.7 volts. It is of the shunt-wound type of dynamo, built for the purpose of incandescent lighting; further than being of greater capacity, and having a hub made of the Cowles aluminum-brass which exhibited a tensile strength of 95,000 pounds per square inch and five per cent. elongation, this dynamo does not differ from the ordinary machine.

Conduction of the Current of the Large Dynamo to the furnace in the furnace room and back to the machine, is accomplished by a complete metallic circuit, except where it is broken by the interposition of carbon electrodes, and the mass of pulverized carbon in which the decomposition of the ore takes place. This circuit consists of thirteen copper wires each 0.3 inches in diameter. There is likewise inserted into this circuit an ampèremeter through whose helix the entire current flows, indicating, by its suction of a plunger armature attached to a spring balance and dial-faced indicator, the total strength of current being used.

This ampèremeter is an important element in the management of the furnace, as by the position of the finger on the dial the furnace attendant can tell to a nicety what is being done by the current within the furnace. It is placed upon a shelf in a good light, near to and in full view of a person in any position about the furnace.

Between the ammeter and the furnace, in the furnace room, and forming part of the circuit, is placed a large resistance coil of German silver immersed in water, a heavy copper slide passing backward or forward as desired, throwing more or less of this resistance into the circuit, and almost the entire energy of the current may be thus applied to heating water. The object of the resistance box is to serve as a safety appliance. It is used by the furnace operator when it is desired to change the current from one furnace to another, or if it be necessary to choke off the current almost entirely before breaking it by a switch, thus preventing serious flashing at the commutator of the dynamo or at the switch. It is likewise of value should any evidence of a short circuit appear in the furnace or elsewhere.

Thus far the apparatus that has been described, presents no novel feature beyond its great magnitude, the peculiar combination made, and the purpose for which it is used. Now, however, we will describe a device that we claim is something radically different from anything that has heretofore been known, namely, an incandescent electrical furnace for the smelting of refractory ores, metals and compounds, and in which other metallurgical and chemical operations, impossible in the past, may now be performed with both ease and economy. This furnace as constructed to utilize the current of the large dynamo, is a rectangular oblong box of fire-brick, with walls, bottom and ends nine inches thick; the interior space being five feet long by one foot wide and one foot deep. This is closed by a cast-iron slab or cover, through which are three three-inch holes for the escape of gases liberated during the operation. This lid may be removed at will, its own weight being all that is required to keep it in place. The walls of the furnace are designed to be air-tight. At both ends of the furnace are holes large enough to admit an enormous electric light carbon three inches in diameter and thirty inches long. Each of these carbons is connected at the end, projecting outside of the furnace, with the positive or negative conductor, as the case may be, the connection being a copper cap fitting over the end of the electrode, the same being fastened to a large and flexible wire cable which forms part of the circuit. When it is desired to charge the furnace, it is first necessary to lime it, to prevent its destruction by heat. To do this a quantity of finely pulverized charcoal that has been soaked in a solution of lime and water, and then thoroughly dried in the drying-pan, is put into the fire-brick box, enough being placed therein to cover the floor to a depth of several inches. The carbon electrodes are then pushed into the box through the end walls until the ends of the carbons are but a few inches apart. These electrodes are just on top of the finely powdered charcoal of the floor. A sheet-iron gauge or guard, parallelogram-shaped, and open at top and bottom, is now placed over these electrodes in such a manner as to form two walls on either side of the electrodes about three inches distant. Space is thus left between the sheet-iron and the walls of the furnace, and likewise for about a foot at each end of the same. More finely powdered limed charcoal is put into the furnace-box so as to completely fill the space outside the sheet-iron gauge and within the furnace-walls and up to within a couple of inches of the top. The furnace is now almost entirely full of the lime-washed charcoal, except the space nine inches wide, three feet long and six inches deep in the centre of the box, and into which the electrodes project.

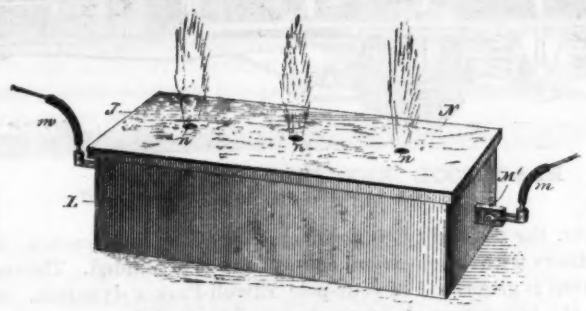


FIG. 1.—PERSPECTIVE VIEW.

FIG. 2.—LONGITUDINAL SECTION.

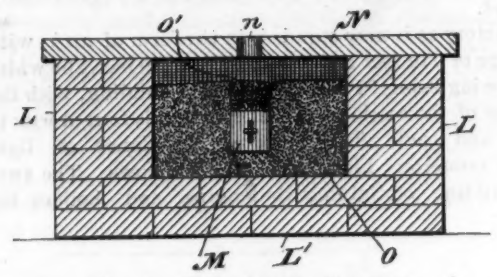


FIG. 3.—TRANSVERSE SECTION.

LL', Fire-brick; *N*, Removable Fire Clay Cover; *n*, Vents for Escaping Gases; *MM'*, Electrodes; *m*, Conducting Wires to Dynamos; *O*, Packing of Fine Charcoal; *P*, Charge of Ore and Granular Charcoal; *O'*, Layer of Granular Charcoal covering Charge on Top.

THE COWLES ELECTRIC SMELTING FURNACE.

All is now ready for the charge, which is prepared. Should it be desired to produce aluminum-bronze, we mix sixteen or eighteen pounds of granulated copper, twelve to fourteen pounds of aluminum oxide in the form of broken corundum, and several pounds of coarsely-broken charcoal together, burying the electrodes with the same, and thus filling the space inside the walls of the sheet-iron gauge. The gauge is then lifted from the furnace, additional coarse charcoal is spread over the entire mass, the iron top of box is put in place, the seams luted with fire-clay, the current from the dynamo switched on, and the furnace is in operation in but little more time than it has taken to give these apparently trifling but very important details.

We will now proceed to make a little study of the philosophy of the process, after first watching a successful "run" or "heat" from the beginning to the close of the operation. Of course, the furnace and its contents, when the current of electricity was turned on, were entirely cold, and the resistance presented to the flow of the current consequently is higher than it would be at any time during the "heat," unless some unforeseen accident, such as a slight explosion of gas, takes place. But, notwithstanding that the furnace is cold, a complete metallic circuit, with carbon tips dangerously near together, is ready to convey a one hundred horse-power flash of lightning into the furnace, should a short-circuit occur. *There are likewise many pounds of pure copper in between and about these carbon tips that may be melted and run together and thus produce a short-circuit. With these conditions, an electrician would insist that the man in charge of the furnace should look pretty sharply, lest the four-thousand dollar dynamo at the other end of the wire be burned out, or somebody be injured by a heavy flash.* The man in charge, however, has anticipated such a contingency by having thrown in several coils of the resistance box, so that under no condition, even if the great carbons in the furnace were pressed tight together, would the dynamo be able to produce a current of more than 1,600 ampères, the maximum load. Upon watching the ampèremeter, however, it is seen that this precaution was not necessary, for only about 200 ampères are indicated as flowing; the artificial resistance is therefore slightly diminished, the needle of the ammeter moves up rapidly to 600 or 800 ampères, suddenly it gives a jump up to 1,200, then back to 200, then, with a bang, the armature of the ammeter is brought against the magnet, and it registers 1,600 ampères of current flowing, and then instantly drops back to almost zero.

As every jump of that needle means wear and tear on the commutator and brushes of the dynamo, care is now taken to keep more control of the current, and a little more artificial resistance is thrown into the circuit. The needle now moves more slowly around the dial, gradually making fewer and fewer jumps, and at the end of eight or ten minutes, it has worked up to the 1,000 ampère mark, and becomes quite steady. Suddenly there is a hiss and a sharp report, a tongue of greenish yellow copper flame darts upward from the hole in the furnace top and then disappears, to be followed after a minute or so by a slight vapor. This was caused by the monoxide of carbon combining with the atmosphere in the furnace to produce an explosive compound. To prevent this gas from accumulating to an extent to raise the furnace top and loosen the luting, the attendant holds a lighted stick over the vent, and a series of slight explosions follow.

Soon a characteristic yellow-white flame appears above the hole, the needle registers about 1,200 ampères of current flowing, all of the artificial resistance is withdrawn, and the process of reducing aluminum and alloying it directly with copper is completely under way. Soon the needle gradually creeps around the dial to the 1,400 or 1,500 ampère mark. This is regarded as being a little too hot work for the dynamo, and at the same time the plume of flame above the furnace indicates a little less rapid reduction. There are, therefore, two things now necessary. The first is to put more resistance into the circuit, and the second is to put more ore into the zone of reduction. These are both done by withdrawing one of the electrodes, and the ammeter needle drops back to 1,200, and the flame above the furnace soon gives evidence of doing more work, by reason of more copious white fumes being given off.

This pulling out of the electrodes is repeated over and over again until both are out to their full length. At the end of an hour the "heat" is completed. The current is then switched to another furnace, but one furnace being used at a heat. The artificial resistance is again resorted to, enough being thrown into the circuit gradually, thus slowly choking off the current, permitting the proper regulation of the brushes on the dynamo, and also giving time for the engine to govern itself. Finally, at the end of several minutes, the switch is thrown open, and the furnace is entirely out of the circuit. Furnace No. 2 is now operated in precisely the same manner as the furnace No. 1, which is allowed to cool off. At the end of two hours furnace No. 2 is thrown out of the circuit and work begun on furnace No. 3. By this time No. 1 is ready to be discharged. The lid is removed and water is used with a sprinkling pot to quench the fire still remaining. At the bottom of the furnace, on the floor of fine charcoal, is found an oblong metallic and crystalline mass of white metal. It is the copper charged with from fifteen to thirty-five per cent. of aluminum and a small quantity of silicon. It frequently averages twenty per cent. to twenty-two per cent. of aluminum and silicon. Covering this mass is also found a considerable quantity of fused carbide of aluminum. Analysis of this product has shown thirty to sixty per cent. of metallic aluminum present. On cooling, it forms very large and distinct crystals.

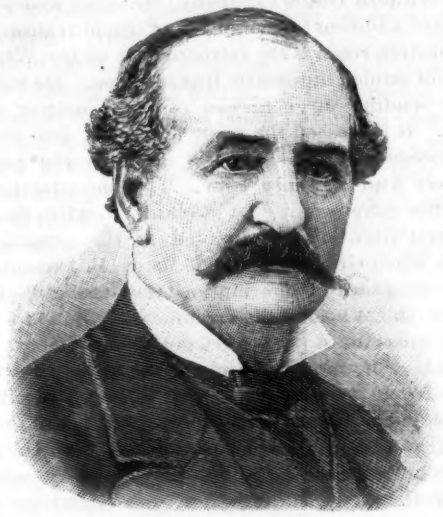
The very rich white bronze is collected together, put into an ordinary graphite crucible, and run into ingots weighing fifty or sixty pounds. These are carefully analyzed by the chemist, after which they are remelted, and copper is added to them in the proper proportion to reduce them to the standard ten per cent. aluminum-bronze. To guard against mistakes being made in the analysis of the white and brittle ingots in the amount of copper added thereto, and in keeping the bronze free from impurity, every ingot of ten per cent. aluminum-bronze has its tensile strength tested, and it must show a tenacity of at least 90,000 pounds to the square inch.

* A paper read at the stated meeting of the Franklin Institute, held January 20, 1886.

Electric Sounding Plates.—M. Semmola, a German investigator, has succeeded in producing musical tones from a metal plate by electrifying it intermittently from an induction machine. The plate is supported on an ebonite funnel and is a millimetre in thickness. The terminals of the induction machine are connected to opposite sides of the plates by wires, and the path of the current is interrupted so that sparks strike across. The plate then begins to sound, and it continues to sound even if a Geissler tube or a lead wire is interposed in the break.

A History of the Telegraph in America.

About two years ago, in referring to some personal changes then going on among telegraphic companies, we ventured the assertion that telegraphic history should be more than a merely dry record of inventions, patents and corporations. It is sometimes demanded of historians that they shall be as precise and colorless in their accurate statements as though they were describing the processes of chemical action, or were detailing observations on the habits of a colony of ants. But while severe, ascetic accuracy of this kind may have its merits, it will never



DAVID BROOKS.

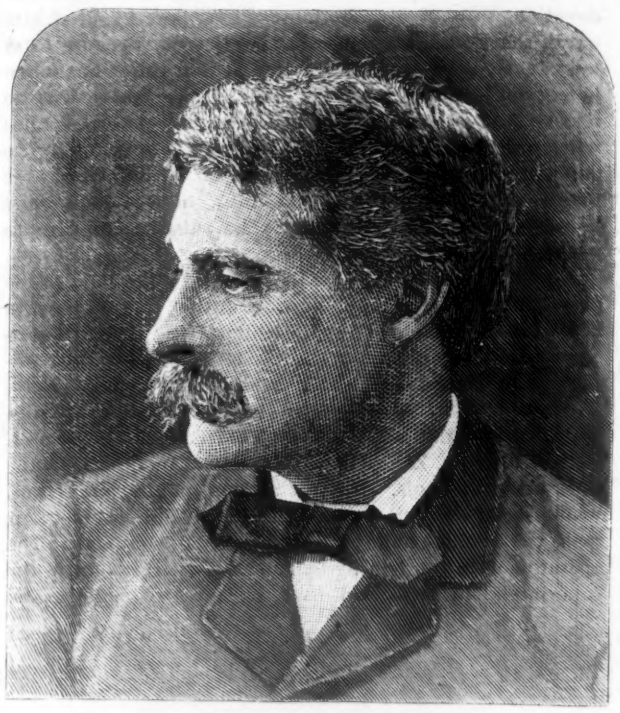
satisfy the public, nor indeed can it do justice to men and events. In true history, as in the poetry that pleases James Russell Lowell, there should always be "the drop of human blood," the beat of human hearts. He will be the popular as well as the best historian who, careful to have his dates verified, and giving full weight to official documents, will seek to make his narrative somewhat less cold and rigid than the postulates and enunciations of mathematical science. He will not disapprove of bright or sombre hues; he will on occasion use the broad brush. He will seek in dusty bundles of old letters for the secret motives of men; he will not despise fashion books, ballad broadsheets, current catchwords, or the cartoons that are the slang of portraiture. Everything that can give atmosphere and animation to the picture will be seized and prized by him, and then his readers will not see the men of old as trees walking, but as beings of like passions, foibles and virtues as themselves. His work will not be a dry list of names, dates and events, but history done to the quick, throbbing in every page with the emotions of bygone days, instinct with poetry and life.

Such is our conception of what general history should be, or the history of any one department of human discovery, endeavor and achievement; and it is because the book in so many respects comes up to a very lofty ideal of this nature, set before himself by the author of it, that we welcome with great pleasure the approaching republication of Mr. James D. Reid's "The Telegraph in America," advance sheets of the second edition now lying before us. Mr. Reid, as is well known, was an early associate and friend of Morse, was also the first telegraph superintendent in

C. W. HAMMOND.

he world, and through all the many vicissitudes of his long and honorable life has been so closely identified with the advance of telegraphy here, that it has been epitomized in his personal career. This in itself is a remarkable qualification for the office of historian, insuring an acquaintance with the men named and an intelligent apprehension of the significance of events. But to all his other eminent merits, Mr. Reid adds the possession of an unusually direct, clear and graceful literary style, as well as an enviable delicacy of wit and a commendable liberality of sentiment. Of course there are various matters in connection with a subject so overloaded with vexed questions as telegraphy, in regard to which Mr. Reid does not win entire approval from everybody for his version of them; but taken all in all, his book is one that will stand, with growing credit to its author, as a brilliant yet trustworthy history of the early days of American telegraphy.

The keynote is struck by Mr. Reid in the following passage: "It is not claiming unusual wisdom when it is asserted that the power of the telegraph as the medium of human intercourse in all its growing forms is largely dependent upon the character, intelligence, energy and prudence of the men who direct it. *Telegraph history is more a story of men than of wires.* Some of the very features which indicate personal refinement touch telegraphic administration. The perfection of the telegraph as a mere physical structure is that it marks the perfection of polite conversation, the absolute absence of interruption. It is remarkable how the fine instincts of a good man regulate his ordinary life and labor, and how other natures are assimilated and affected thereby;" Mr. Reid's position or argument is our own. Everything that can knit a community together, cause a rapid interchange of sentiment and ideas, and annihilate distance, is of the greatest good to the largest number. To draw a parallel, the running of express trains implies efficiency of service, punctuality, the highest type of executive officer, the finest make of locomotive, the smoothest roadbed, concentration of skill and experience, the knitting of every nerve and energy, and the performance of downright good work straight along the line by all concerned. In the same manner the dispatch and receipt of messages by telegraph or telephone implies the higher development of social, political and commercial life, and since the history of the telegraph is rather a story of men than of wires, it becomes highly interesting to know something of the men who have helped to



ALBERT B. CHANDLER.

organize, or are now operating the telegraphs of the country. Hence one of the features of especial attractiveness in this second edition is the fine collection of wood engravings executed by Mr. Thomas L. Smart, whose name alone is a guarantee of faithful work. These new engravings, additional to the twenty-four steel plate portraits and the other illustrations, are of the following well-known men: Jay Gould, A. B. Chandler, R. H. Rochester, John B. Van Every, A. R. Brewer, J. J. Dickey, E. P. Wright, J. W. Holmes, R. T. Clinch, C. O. Rowe, David Brooks, W. J. Dealy, Geo. G. Ward, Willard Brown, Geo. A. Hamilton, Gerritt Smith, G. D'Infreville, J. E. Fenn, J. F. Wallick, I. N. Miller, W. C. Humstone, S. B. Gifford, E. A. Leslie, C. W. Hammond, T. Brennan, R. S. Guernsey and J. J. Kiernan. We have picked out a few of these engravings, haphazard, to show the generally high quality of the work. The personal details accompanying the woodcuts are, as might be expected, of a very interesting nature. Thus of Mr. A. B. Chandler, whose energies have carried him far beyond the range of telegraphy, we are told that he began work in 1857 in the service of the Vermont and Boston Bain Telegraph Company, being stationed at West Randolph, Vt., and it is said of him in his later connection with the Western Union Company: "In every relation he proved himself more than equal to the duties assigned him, honoring every trust with conscientious assiduity, and by the unfailing politeness, fidelity and thoughtfulness with which he administered it." Mr. Chandler has interested himself in cabling and in electric lighting, but Mr. John Jay Dickey has come to the front in telephonic affairs west, being Vice-President of the Nebraska Telephone Company and of the Rocky Mountain Bell Telephone Company, in addition to having charge of the Western Union Third Central District, with 850 offices and 1,125 employés. Mr. Dickey, whose father was the late Chief Justice of the Supreme Court of Illinois, served as an operator on the Chicago & Rock Island Railroad from 1859 to 1863. He is naturally spoken of as "one of the most thoroughly wide-awake, active and efficient men in the Western service." In contrast, in some respects, with that western district comes the First Eastern District, of which Mr. Walter Coutant Humstone has charge. Mr. Humstone began his lifework in 1862 as a messenger boy at Poughkeepsie, and as he is only thirty-seven years of age he is a good example of rapid rise by merit. His district contains 1,136 offices, with a staff of about 3,000 employés. "The management of the office in New York alone is worthy of, and has appointed to it, a man of first-rate ability. * * * The work in it is incessant, day

JOHN JAY DICKEY.

and night, and knows no holiday or Sabbath or rest, except to a limitation of the force when business relaxes. Connection with the round world makes the telegraph service like death, which 'has all sea sons for its own.' Day and night cease to have meaning when midnight telegraphs to high noon, and the twilight of England whispers to the sunset of Japan." Mr. Humstone has care also of 140 local cables with 752 conductors. As to Mr. Gerritt Smith, who entered the telegraphic service in 1853, under the Commercial House Printing Telegraph Company at Boston, a strong claim is made. "In the Western Union system, there are 140 quadruplex circuits, that is, 140 distinct sections of line on which the quadruplex mechanism is employed. These cover 41,970 miles of actual wire, and indicate as the product of the quadruplex system 125,190 miles of unseen or 'phantom' line, *i. e.*, one visible and three invisible wires. After a thorough examination of these circuits under ordinary conditions, it was found that of these 125,910 miles only 83,940 were available, and that even of these one-third of the signals were irregular and uncertain. By Mr. Smith's improvement the quadruplex wires were brought up to their full mileage capacity of 125,910. Nor is this all. Wires of number 8 gauge, the largest used under ordinary conditions, when exceeding 300 miles in length, could not with the existing quadruplex mechanism be worked satisfactorily to exceed a mere duplex capacity. By the introduction of Mr. Smith's improvement, wires of number 8 gauge up to six hundred miles in length are made available for full quadruplex service, and it is not the least meritorious fact connected with this very useful improvement, that

WALTER COUTANT HUMSTONE.

as if to prove the fact that it had removed a formidable obstruction to telegraphic work, the quadruplexed lines can now be operated with maximum efficiency after a reduction of at least one-tenth of the battery ordinarily employed. No more remarkable service has been rendered to the telegraph in recent years. The truth is that the quadruplex system, but for Mr. Smith and the many helping devices he has applied to it, would have been practically valueless." Two other well-known men at "195" are Mr. W. J. Dealy, the manager of the operating room, and his assistant, Mr. Thomas Brennan. Mr. Dealy's connection with

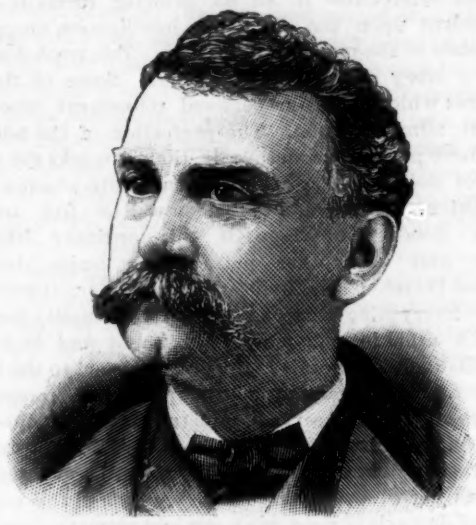
the telegraph dates back to August, 1857, when he entered the service of the old Atlantic & Ohio Telegraph Company as messenger. In describing his career, Mr. Reid says: "A man thus trusted needs no other record. His post is one of unceasing labor and of great responsibility, to which he gives the most loyal devotion. Mr. Dealy is held in very high esteem." Mr. Brennan began telegraph life in 1861, with probably as much nervousness as now fills each of the applicants to him for appointment, numbering hundreds every year. Another well-known New Yorker who has made his mark is Senator John J. Kiernan, now proprietor of the financial news agency bearing his name in Wall street. Few men are better known than he to all doing business on the Stock Exchange. Mr. Kiernan entered the service of the Magnetic Telegraph Company in 1858.

Veterans in the telegraphic field will be glad to see the portrait of Mr. C. W. Hammond, late President of the Old Timers' Association. Yet another of the Nestors is David Brooks, who is not only one of the earliest telegraphers living, having been associated with Henry O'Reilly in 1845 in putting into operation the first commercial line in America, but is one of the foremost in dealing successfully with the increasingly important subject of underground wires. It is noted also in Mr. Brook's record that he went from this country in 1851 to construct the first telegraph in Mexico.

In Mr. Reid's book, the biographical sketches of all these and many other prominent men are given with fullness and much piquancy of detail. It would be easy to fill pages with interesting bits of description and pen portraiture. Take for instance, the following about Andrew Carnegie, now the largest manufacturer of iron, steel rails

WILLIAM JOSEPH DEALY.

and coke in the world, but once Mr. Reid's messenger at Pittsburgh: "It must have been somewhere in the winter of 1847–48 that a very small boy, with a curious stray lock or two of very light hair falling across a well-developed brow, with a look alike confident and modest, and with a vernacular very decidedly Scotch, applied for employment at the office of the Atlantic & Ohio Telegraph Company in Pittsburgh, Pa. He gave his name as Andrew Carnegie, born in Dunfermline, Scotland, in 1835, and who was at that time, although barely thirteen years of age, running a small stationary engine in a cellar not far off. Of course the smell of heather so discernible upon him was not greatly against him in the eyes of a man born at Dumbiedykes, and so 'Andie' was engaged as messenger at $2.50 per week. Of Mr. Carnegie's entrance into the Pittsburgh telegraph office he was since written: 'My entrance into the telegraph office was the transition from darkness to light; from firing a small engine in a dirty cellar to a clean office where there were books and papers. That was paradise to me, and I bless my stars that sent me to be a messenger boy in a Pittsburgh telegraph office.' As a messenger, young Carnegie showed himself prompt, reliable and knowing, and soon became a favorite." A neat little touch is put in as to Dr. Norvin Green: "Here the chief officer may always be found, usually smoking a good cigar, and at the same time disposing of a large round of duties, and receiving numerous visitors with a leisureliness which indicates the mastery of labor." This is not bad, either, about Vice-President Van Horne of the Western Union: "He is tall, spare, square-shouldered and of unhurried and thoughtful movement. His eyes are gray, a little repellant—as if on guard—and there is a roundness of the head above the ears that indicates will. Yet his look is unassertive, thoughtful and lonesome. There is an utter absence of self-consciousness. His manners are quiet, as of a man who had some thinking to do of his own which he did not care to reveal. But he opens up like a morning-glory to the touch of humor. He delights in a good story, and can laugh from his eyebrows to his toes, hugging his lifted knees in keen delight." Friends of Georges d'Infreville will be amused when they see him sent down to posterity as "an effervescing Frenchman, good hearted, full of knowledge, ingenious, valuable, spirited, impatient—he makes a court room lively as a witness." It is not to be supposed, however, that Mr. Reid confines his attentions to the company with which he is connected. He gives a large amount of information, succinctly, about the Baltimore & Ohio and other corporations, as well as about the men who carry on their work. Thus of Mr. John E. Zeublin, now General Superintendent at Chicago for the Baltimore & Ohio, we have this about his war service: "He was detailed by Gen. Eckert to join the construction corps under Dennis Doren. He was much surprised one fine morn-



GERRITT SMITH.

ing by being stirred out from a Confederate coffin, into which he had gone to rest, by his sleepless chief rousing him in somewhat warlike tones to commence a march on Strasburgh. Mr. Doren, who is a good judge of men, and who, when on duty on the field, needed men of nerve and devotion, says of Mr. Zeublin: 'I suppose I routed him out of that coffin in a somewhat lively style, because I did not exactly need a man in a coffin at that time, but when he got out he proved a very lively corpse; there was no service too hard for him and no danger deterred him; when ordered to perform a duty, he would go through fire and water to do it; I had under me no better or brighter man.' After the battle of Antietam, he was summoned home, where not long afterward he raised a company to resist the Morgan raiders."

A very interesting chapter is devoted by Mr. Reid to the press and the telegraph, and the author therein tells, in new guise, a good story against himself. "The first serious undertaking to supply the Western press was the sending of the phenomenally long message of President Polk, December, 1848. Arrangements had been made to attempt by one manipulation to send it to Pittsburgh, Cleveland, Detroit, Buffalo, Zanesville, Columbus, Cincinnati, Louisville and St. Louis. But on account of a severe storm, which set in soon after its successful commencement, it took two nights and part of one day to complete. The operators were thoroughly exhausted. At Pittsburgh, the superintendent, who had been up for two nights, and

JOHN J. KIERNAN.

whose own eyes were nearly closed with sleep, had to relieve the overpowered operator, took the key, and after some weary hours, finished the message by unconsciously sending over the wire in the joy of a great relief, the cry of the Spaniard, with the name of the President, 'God and Liberty! James K. Polk!' Some of the wearied editors published both to the world! How they howled next day! George D. Prentiss asked in the *Louisville Journal* with irreverent sharpness, 'What had James K. Polk to do with either God or liberty?' and thought the miscreant operator should be publicly beaten with Santa Anna's wooden leg. Was he discharged? Well, he might have been, but he could not well discharge himself, and—he still lives to write this record against himself."

On a variety of important points, this second edition is full of valuable matter. An excellent table is given of the telegraph companies in America, and it will doubtless surprise many people to learn that the number is 217. The total mileage of wire is 671,002 as compared with 1,022,500 in all Europe, Asia and Africa. The total number of telegraph employés in the world is set down at 324,773. With regard to the growing use of the Wheatstone system by the Western Union Company, Mr. Reid writes: "One important addition to the means of rapid transmission in the operating room is the introduction of the Wheatstone system of duplex automatic transmission. Its use in England in sending large masses of press matter was well known. It increased the value of a wire, but required a large accession of workers, and involved the hazards of imperfect and slovenly copy. The introduction of the typewriter gave promise of advantage with the Wheatstone, and attention was directed to the general system. In 1874, when Gen. Eckert and Mr. G. B. Prescott visited Europe on a tour of information, they brought with them a set of the Wheatstone machinery to add to the telegraphic museum of the electrician's department. No use was made of it, except in some of the tests in working out the quadruple system under Mr. Edison. In 1881, however, as public demand upon the wires had greatly increased, and their multiplication to transmit the business of the country began to be a somewhat perplexing problem, Mr. George A. Hamilton, of the electrician's department, was instructed to attempt the use of the Wheatstone, between New York and Chicago, in the transmission of ordinary business. The attempt was successful enough to determine the company to introduce it." The system is now in constant use between New York and St. Louis, New York and Chicago, New York and New Orleans, St. Louis and Kansas City, and Kansas City and Chicago, while other extensions are in active preparation. One other subject handled is the strike of 1883. As the sympathies of this paper were then aroused and exerted in behalf of the operators, it is not to be expected that we can approve very warmly Mr. Reid's version of the sad affair, writing as he does from an official standpoint; but we will say this for him, that while his pen and his intellect are employed in recording the various incidents as the officials saw them at the time, he is not without some very tender feelings for those who fought and suffered on the losing side. He says, "speeches were made full of the fire of youthful blood, and yet which were worthily marked with deprecation of violent methods to secure their ends;" and he says, too, with truth that "there was without doubt much heroism."

THOMAS BRENNAN.

The book will be ready early next month, when the demand will naturally be great. The first edition cannot now be got, and this second will in a very few years be held at double and treble price, being limited to a thousand copies. We understand from Mr. Reid that he will publish it in beveled cloth boards for five dollars, and in Russia leather for eight. When to what we have said about the illustrations, we add that it will contain close on 1,000 pages, admirably printed on fine paper, it will be seen that the book is one that all should have, and can have, if they are prompt in securing copies.

Torpedo Building.—The Sims-Edison Electric Torpedo Company has been incorporated by Thomas A. Edison Charles Bachelor, Gardiner C. Sims, W. Scott Sims, Lewis May, John Anderson, William M. Deen, Frank W. Allen, and George H. Stayner. It is to manufacture, sell, and use torpedoes, torpedo boats, submarine vessels, and war ships, war materials, electric machinery and instruments, dynamo machines, electric cables, wires, motors, and lights, and also steam engines, boilers, and supplies. Its capital stock is $1,000,000, divided into 10,000 shares of $100 each.

An Electric Device for Testing Regularity of Engine Revolution.

Among the recent reports issued by the Franklin Institute on exhibition tests is the "Steam Engine" report, which contains the results of tests of various engines, and among other interesting matter is given the method employed of ascertaining the regularity of speed of the engine during different parts of the stroke.

The apparatus employed for the purpose is shown in the accompanying diagram, Fig. 1, and the record made is shown in Fig. 2.

All the apparatus, excepting the piece marked *T* and the cells marked *V*, *W* and *X*, is on one base and operates as follows: The tuning fork *Z* is kept in vibration by means of the single Leclanché cell *X*, which is connected to the binding posts *A* and *B*. *A* is connected directly to the tuning fork *E*, as the whole apparatus rests on an iron base, and *E* and *A* are not insulated. The current passes from *X* to *B*, then around the magnet *G*, then to the insulated contact piece *F*, through the contact piece to the fork *Z*, from *E* to *A* and back to the cell *X*.

The vibration of the fork makes and breaks contact at

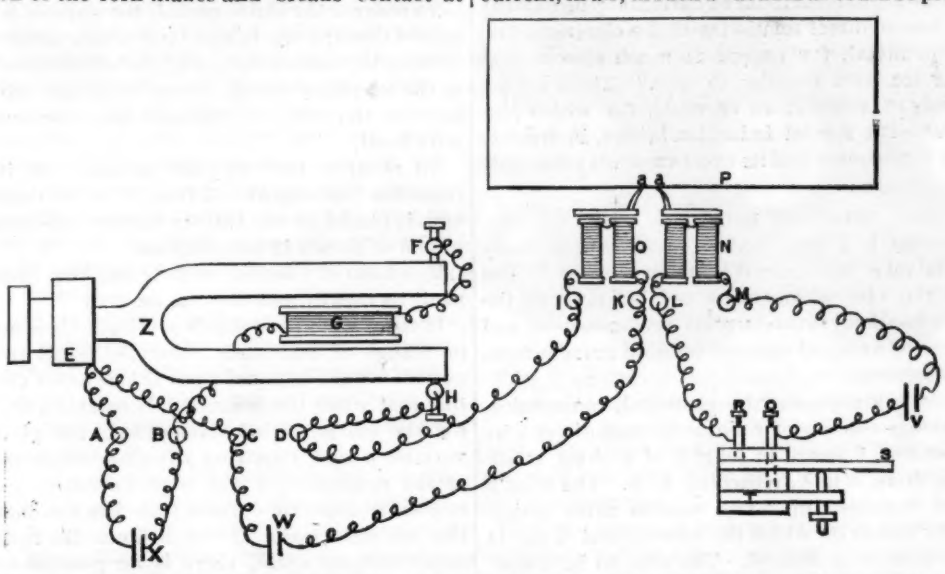


FIG. 1.—DEVICE FOR TESTING REGULARITY OF ENGINE REVOLUTION.

F, magnetizing and demagnetizing *G* and keeping the fork vibrating with about a constant amplitude of vibration.

The nearly continuous line of Fig. 2 is from one of the armatures, making record of the revolutions of the engine, and as the circuit was broken at only one point in the revolutions, the tracing point would make a continuous line, except during one small interval. The dots right under this line are made by the other armature, connected with the tuning fork.

The drum *P* is the drum on which the records are made. *N* and *O* are two small magnets with their armatures balanced horizontally in such a way that while the circuit is closed through them, the points, *a*, *a*, rest against the drum, and when the circuit is open a light spring draws the points clear of the drum. The magnet *O* is the one represented as recording the vibrations of the fork. The binding posts *I* and *K* are connected to the coil of the magnet.

The current from the cell *W* passes from *W* to the uninsulated post *C*, from *C* through the frame to the fork *Z*, through the contact piece to the insulated post *H*, which is connected to the binding post *D*, also insulated. *D* is connected to *I* and the current, after passing through the coil of the magnet, passes through *K* back to the cell *W*. As the current is broken at *H* the point *a* is raised from the drum *P*, and as soon as the circuit is closed, the point *a* again rests on the drum *P*.

The record of the other magnet is made as follows: *T* is the break circuit piece. It consists of two brass pieces, *S* and *T*, insulated from each other and connected to the binding posts *R* and *Q*. *U* is a contact screw. *S* is put in such a position that a projection on the engine strikes *S* once a revolution, breaking contact with *U*. Connections are made, as shown, to the magnet *N*, and when the circuit is closed, the current flows through *M*, *N*, *L*, *R*, *S*, *U*, *T*, *Q*, and back to the cell *V*, in the order named.

The break in the continuous line marks each revolution, and hence the spacing between the dots of the other at each successive point gives the speed at that point in the stroke.

The New York Electrical Society.

At the last meeting of this society, Mr. Henry D. Hall, the inventor of the ozone machine, which we described and illustrated in our issue of September 19 of last year, delivered an interesting lecture upon the generation of ozone by statical electricity. The meeting was held in the rooms of the Ozone Machine Company, in the *Post* Building, in Broadway, and the modified Holtz machine employed was run by an electric motor connected to the Edison electric light circuit. Mr. Hall, after describing the principles of his machine, gave a résumé of the uses to which ozone can be applied in the arts and in medicine, and demonstrated its utility for numerous purposes.

The society has now under consideration a proposition to join the American Institute as a sub-section on electricity. This will give it the use of a large hall and library, and would appear in every way to be a decided benefit, while leaving the society its autonomy.

The Salient Points in the History of the Incandescent Electric Lamp.

To the Editor of The Electrical World:

SIR: The phenomenon of the voltaic arc, upon which depends the operation of the arc lamp, was a distinct discovery made by Sir Humphrey Davy in 1809. The fact that heat and light could be produced by passing the electric current through poor conductors, the underlying principle of the incandescent lamp, was then well known. For producing his voltaic arc, the properties of which he fully investigated, Davy used sticks of wood carbon, which he describes as pieces of "well burnt compact boxwood charcoal." His experiments were also extended to producing light by the incandescence of carbon, and thin slips of the wood carbon were brought to incandescence by the electric current, in air, in such a vacuum as could be produced under the bell jar of an air pump, and also when the bell jar was filled with nitrogen and various other gases on which the incandescent carbon had no power of chemical action. It does not appear that Davy thought to provide any receptacle for his incandescent carbon other than the bell jar of the air pump, but, except in the making of a globe detachable from the air pump, he anticipated many of the most successful attempts of later experimentalists.

These experiments of Davy were used in part later on by Children, Daniell and others in testing galvanic batteries, and the ascertaining of the heating power by incandescence and the voltaic arc became one of the regular tests for all large batteries.

In 1840 the first English patent was taken on the subject of lighting by electricity, and in 1841 the first electric lamp was patented by De Moleyns, who proposed to increase the light emitted by an incandescent platinum wire by a spray of finely pulverized boxwood charcoal or plumbago. The first electric lamps that were publicly exhibited and caused any considerable comment in technical journals were the incandescent lamps of Starr in 1845 and Staite in 1848. Starr proposed to use a carbon stick in a Torricellian vacuum, formed by filling the globe and a tube attached thereto with mercury and then reversing the parts, bringing the globe uppermost. Staite's construction was an arched conductor of iridium or iridio-platinum wire placed in a protecting globe resting on a metal or glass plate through which the supports for the incandescent arch passed.

These were followed by Nollet and Shepard in 1850, who proposed a charcoal rod in a vacuum fed forward by a weight on to a carbon cone; and Roberts who in 1852 placed a carbon rod in a rarified deoxygenated atmosphere of nitrogen or hydrogen. The subject of lighting by incandescence was suffered to lie idle from about this time until revived in 1872, between which year and 1876 appeared the lamps of Lodyguine, Bouiliguine, Konn, Kosloff, Khotinsky and Fontaine. These were all carbon rods or arches of carbon, some in a partial vacuum and others in an atmosphere of nitrogen, and most of them provided with a number of carbons which were brought into circuit successively as the carbons gave out. Lodyguine, whose public success was greatest, lighted wholly or partially a public hall in St. Petersburg in 1873 with his lamps on the occasion of a number of evening lectures upon electric lighting, and he was awarded a special prize by the Academy of Sciences at St. Petersburg. The lamp used by him at these lectures was composed of a charcoal rod inclosed in a globe filled with nitrogen. Khotinsky, who took a patent in France in March, 1875, had a well considered construction for a multiple carbon lamp, of the same character and quite closely of the same constitution as the lamp patented in England by Konn, the same year. Khotinsky also proposed the arrangement of the lamps in multiple arc, and provided a key to light and extinguish each lamp at will and an ingenious contrivance for turning the light at each lamp up and down to give more or less light. His patent, however, was overlooked by Fontaine in his work on the electric light, published in 1877, and this oversight has been followed by subsequent writers.

But all of the incandescent lamps referred to fell short of practical and commercial success. With the light afforded by the development of the art since that time, we can see that the reasons for that failure are numerous. These lamps had carbons of low resistance, in no case probably more than five ohms and in most instances only one or two ohms. We now know that the obstacles in the way of practical success with carbons of such low resistance are insurmountable. They cannot be clamped at the ends for circuit connection; when held rigidly they break by expansion and contraction; when provided with sliding or rolling contacts the connection is poor. The wires leading to such carbons have to be large in size in order to carry the current and cannot be successfully sealed into glass; this makes it impossible to maintain stable the conditions (whether of vacuum or inert gas) existing in the lamp globe at time of sealing. These are considerations relating to the lamps alone. Considerations of economy in cost of conductors and in distribution of current would make it necessary to arrange such lamps in series; this, with the desirable simplicity of parts, would not permit of a separate control of the lamps, and is not a practical arrangement for domestic illumination.

The lamps that have been referred to also had their globes closed at one or more points by metal caps cemented to the globe or a glass plate similarly cemented to the globe. Such a joint has no lasting stability either to hold a vacuum or an inert gas. Since the experimentalists had no means of forming a suitably high vacuum, however, they preferred in most cases to use an atmosphere of nitrogen, and this preference was accentuated by the fact that all the lamps were designed to be taken apart for the removal of the carbons. The possibility of producing a structural unity, a lamp intended to be thrown away when the carbon was broken, had not been entertained. This is one of the most tangible features of all commercial lamps of to-day.

The use of an inert gas in the lamp globe instead of a vacuum is now generally recognized as impracticable, since the loss of power and light by the convection of heat from the incandescent carbon to the globe and radiation therefrom is considerable. The carbon is also rapidly wasted away by currents of the inclosed gas "washing" its surface.

FIG. 2.—RECORD OF ENGINE REVOLUTION.

These experimentalists had straight and arched carbons; carbons fibrous and non-fibrous; attempted vacuums and inert gases; but they did not reach the goal! Why? Because they were proceeding upon incorrect principles—the low resistance carbon and the separable lamp structure.

In 1878, W. E. Sawyer, of New York, went over the ground well worn by prior electricians and produced the improvements in details that have been patented in the joint names of Sawyer and Man. He displayed great ingenuity, but was bound by the dogmas of the art and sought for the solution of the problem of lighting by incandescence in low resistance carbons, separable globes and inert gases. He produced no new type of lamp, but confined himself to improvements in detail useful only upon the type of lamp then well known. Some notoriety was given Sawyer's experiments by the press, but no more so than the inventions of Starr, Staite and Lodyguine received in their times and in the localities where their lamps were

exhibited. Sawyer's lamp was never capable of being put into practical use. The facts that his experiments were contemporaneous with those of Edison, that the company incorporated to exploit them survived the time when Edison made lighting by incandescence a success technically and commercially, and that the field promised money returns sufficiently large to dull the conscience of capitalists already out of pocket in the same direction, account for the present existence of a company which manufactures the Edison lamp and seeks to shield itself behind the Sawyer and Man patents.

The experiments of Edison on electric lighting commenced in 1877, although he had made some fundamental experiments before that time. They were renewed in 1878, and continued through 1879 with a working force of forty assistants and a large expenditure of money, directed not only to the obtaining of a lamp, but all the other devices necessary for complete isolated installations and central station systems. Probably upon the production of no invention had such forces been before utilized; the history of great inventions fails to show a single instance of the exhibition of equal fertility of inventive resource. In the latter part of the summer or early in the fall of 1879, Edison produced the type of lamp now in general use. He exhibited it to the public in December, 1879, and the manufacture for commercial purposes was soon after commenced. This lamp has, as is well known, a carbon "filament" for the incandescent conductor; this is a thread or hair-like conductor of carbon possessing the qualities of high resistance and flexibility. The lamp is a structural unity; it cannot be opened to renew the carbon. The globe enclosing the filament is entirely of glass, all joints being closed by the fusion of the glass together into a single piece, and small platinum wires leading current to the filament being fused into the glass where they pass through the walls of the globe. The globe is exhausted to a high degree of vacuum before being finally closed.

This lamp is different, not only in detail, but in the principle or type from the lamps of prior inventors. The carbon filament has a high resistance, of 100 ohms and more. This permits of a subdivision of the current between lamps in independent circuits and separately controllable, and since a small current is sufficient to raise the fine filament to incandescence, small platinum wires can be used without danger of heating, and these can be permanently and hermetically sealed into the glass, since the co-efficient of expansion is practically the same as that of glass. The filament also has flexibility and can be rigidly clamped at its ends, the filament by changing in shape taking up within itself the expansion and contraction, and that without breaking the filament or straining its connections with the circuit wires. The vacuum obviates the loss due to convection of heat by an inert gas, and the destruction of the carbon by air washing. The stability of the vacuum is assured by the perfect seal of the small platinum wires, and by the construction of the globe entirely of glass. This last feature renders the glass work useless or undesirable for re-employment after the carbon once breaks; but the life of the carbon is sufficiently long under the conditions present in the lamp, and the construction of the lamp so simple and inexpensive, that this consideration becomes unimportant compared with the advantages arising from the use of the construction referred to.

In all its essential features, the Edison lamp is manufactured by the several companies engaged in the business of furnishing incandescent lamps to the public. Maxim, Weston, Swan, Stanley, Perkins and others, who have acted or are now acting as electricians for such companies, have produced some peculiarities in detail, which, without changing the principle of the lamp, give it a somewhat different appearance, such difference, however, in most instances being only discernible to the eye of the technologist.

RICHARD N. DYER.

The Edison Central Station for Boston.

Work has lately been pushed with energy on the Edison electric lighting central station in Boston. A twenty years' lease has been taken of land in the rear of the Park Theatre, off Bumstead court. The work will be pushed as fast as the weather will permit. For the present a brick building will be utilized for a boiler-house. Later a large four-story station will be erected. The contract for erecting this station and providing it with the steam plant has been awarded to the Jarvis Engineering Company of Boston. Their reputation for quick work is a guarantee that the work will be finished at the time stipulated. The contracts call for lights to be running in the Bijou Theatre on February 22.

The engines are of the Armington & Sims Co. type. The boilers will be of the flange steel tubular type, and manufactured by the Whittier Machine Company of Boston. They are 6 feet in diameter by 17½ feet in length, with 140 tubes 3 inches in diameter. They will use the National rocking grates and the boilers will be set with the Jarvis patent furnace, burning coal screenings for fuel.

It is the intention to start this station with 2,000 lights of sixteen-candle power each, to be increased eventually to 6,000 lights. They will be used by the theatres, stores and hotels in the vicinity and the wire will be run under ground. This will be the first station started in Boston on the Edison system.

The Self-Induction of an Electric Current in Relation to the Nature and Form of its Conductor.*

BY PROF. D. E. HUGHES, F. R. S.

Induced or secondary currents in a near but independent circuit were discovered by Faraday in 1831; and the phenomenon of the self-induction of an electric current in its own wire was observed by Henry in 1832, and traced to its cause in 1834 by Faraday, who proved that on sending a current through a wire a momentary induced current in the opposite direction is evoked in its own wire; also that, on the cessation of the primary current, a second induced or "*extra-current*" is excited in the direction of the primary. The effect is greatly augmented when the wire forms a coil, as we then have in addition the reaction of superposed currents; but the effect exists to a great extent even when the wire forms but a single loop, or a straight wire with the earth forming the returning portion of the loop, as in all telegraph lines.

It has been generally supposed that the nature or the molecular condition of the metal through which the primary current passed exerted no influence upon the extra-currents except that due to its resistance. I have previously pointed out† that for induced currents "the rapidity of discharge has no direct relation with the electrical conductivity of the metal, for copper is much slower than zinc, and they are both superior to iron." These led me to make a study of these extra currents, for which purpose I constructed a special induction bridge, in order to measure both the primary and its extra-currents separately at the instant of action.

INDUCTION BRIDGE.

This instrument is a combination of a portion of my "Induction Balance" with a "Wheatstone Bridge." The resistance of the wire is measured and balanced by the bridge; the induced or extra-currents are measured and reduced to zero by an equal opposed induced current from the induction balance.

The diagram below shows the electrical communications. The bridge consists of a single German silver wire (0.25 mm. diameter, 1 metre in length, of 4 ohms resistance) running from *A* to *K*, returning to *B*. The wire is stretched and sustained upon two wooden arms articulated at *K*, by means of which the terminals *A B* can be more or less separated as desired. The wire to be tested, *X*, is joined at *A* and *B*, thus completing the closed circuit of the bridge.

The external communications are shown, *A* being connected to the primary coil of the sonometer *E*, and through it to the spring of the interrupter or rheotome *G*, the interrupting wheel being connected to the battery *H*, and thence to the bridge at *C*. The wire from *B* passes through the telephone *I* to the secondary coil *F*, returning to *D*.

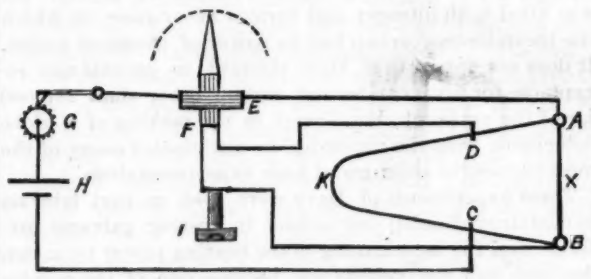


DIAGRAM OF INDUCTION BRIDGE.

Great care has to be taken in the construction of the bridge, so that it shall be as free as possible from induced or extra-currents; and for this reason we cannot employ or introduce resistance coils. The resistance of the wire *X* is balanced by sliding the communications *D* and *C*. It is evident that if all the arms of this bridge are equal in resistance and inductive capacity, there will be silence in the telephone; but if *A B* be slightly stronger or weaker in inductive capacity, then we may be able to balance its resistance, but not its induction, as we shall then have a slight or a loud continuous sound, due to the differential extra-currents in the arm *A B*. These are compensated by the introduction in the circuit of the telephone of an equivalent but opposed induced current from the secondary coil of the sonometer *F*, the degree of angle through which this coil has turned to produce silence being the degree of force of the extra-current. The induction sonometer‡ consists of two coils only, one of which is smaller, and turns freely in the centre of the outside coil. The exterior coil being stationary, the centre coil turns upon an axle by means of a long (20 cm.) arm, or pointer, the point of which moves over a graduated arc or circle. Whenever the axis of the interior coil is perpendicular to the exterior coil, no induction takes place, and we have a perfect zero; by turning the interior coil through any degree, we have a current proportional to this angle, and in the direction in which it is turned. The value of the induction current for each sonometric degree was $\frac{1}{2100}$ of the primary current which passed through the wire under observation, the latter being variable at will from .001 to .250 ampère. There is also a reversing key (not shown in the diagram), in order to place the interrupter on the telephone circuit and close the battery current from *H* to *A*; the conditions then being the usual method of testing, except using the telephone in place of a galvanometer—a well-known method. The telephone, being exceedingly sensitive and rapid, is most suitable, while a galvanometer would be too slow, and its use, in fact, impossible for the researches I have been making.

Numerous details have been necessarily omitted in this rough sketch of the instrument. Suffice it to say, that it is perfectly adapted for the object sought, viz., the investigation and measurement of the self-induction which takes place in all wires.

By all previous methods the measurement of the resistance of a wire is taken when the current has been already some time in action, or, to use an expression of M. Gaugain, when the electricity has arrived at its "stable period." In telegraphy, electric lighting, and all applications using rapid electrical changes, another period has to be considered, viz., that during the rise and fall of the current; this he named "the variable period," and it is in this period that all the phenomena of induction take place.

To observe the *stable* period, the current is continuously passed through the bridge (and consequently through the wire under observation), and the interruptor being placed in the telephone circuit allows us to find the exact resistance of the wire, free from all induction or change in the wire itself.

To observe the *variable* period, the interrupter or rheotome (making at will from 10 to 100 contacts per second) is placed on the battery circuit, the telephone being joined as shown in the diagram.

By means of a switch or reversing key, these changes are made as rapidly and often as desired.

If there were no static or self-induction, no loss of time, or change of resistance, then the result from these two periods would be equal; but this is never the case, for we find that when the resistance is balanced to a perfect zero for the stable period, loud sounds are given out in the variable period, requiring a fresh adjustment or balancing of the resistance of the wire, as well as a compensating opposing induction current from the sonometer to balance the self-induction. If we balance the resistance or the extra-currents alone, there is no possible zero, but when both are compensated, we find at once a perfect zero for the resistance of the wire, and for its extra currents.

(TO BE CONTINUED.)

* Inaugural address as President of the Society of Telegraph Engineers and Electricians.

† "Induction-Currents Balance," *Proc. Roy. Soc.*, vol. xxix., p. 56, 1879; "Molecular Electro-magnetic Induction," *Proc. Roy. Soc.*, March 7, 1881.

‡ *Comptes Rendus de l'Académie des Sciences*, Paris, Dec. 30, 1878, and Jan. 20, 1879; *Proc. Roy. Soc.*, vol. xxxi., p. 527, 1881.

A New Solution for Electro-Deposition of Metals.*

BY G. GORE, LL.D., F.R.S.

The liquid employed was an aqueous solution of asparagine. It was not quite saturated, and consisted of about .88 gramme of crystals of the substance, dissolved in 18·cc. of distilled water. The solution was faintly acid to test-paper, and was used at a temperature of about 70°C. Portions of this liquid were more or less saturated with different metallic oxides, and the resulting solutions electrolyzed by currents from one to six voltaic couples, consisting of zinc and platinum in dilute sulphuric acid. The electrodes had usually one square centimetre of surface on each side.

Experiment 1.—.23 gramme of hydrated oxide of cadmium was mixed with about 20 cc. of the liquid; it did not all dissolve, and the solution was feebly alkaline. The mixture was electrolyzed with an anode of cadmium and a cathode of copper. Adherent, white, reguline deposits of cadmium were easily obtained; no gas was set free at either electrode, and the anode remained clean and bright.

Experiment 2.—.28 gramme of zinc oxide was added to about 23·cc. of the liquid; the latter became alkaline. With a zinc anode and copper cathode, and a current from six cells, a moderately good deposit of metal was produced. No gas was evolved.

Experiment 3.—By using calcined magnesia in place of oxide of zinc, a current from six cells, and a magnesium anode, a film only was deposited upon the copper cathode, and that film evolved gas distinctly when wetted with dilute sulphuric acid. The amount of deposit was not increased by using a larger anode, a smaller cathode and a more concentrated solution. Much gas was then evolved at each electrode. The mixture was alkaline to test paper.

Experiment 4.—.9 gramme of cupric oxide was partly dissolved to a blue liquid in 23cc. of the solvent. With a copper anode and a platinum cathode, a small amount of reguline metal was deposited by a current from six cells. Addition of a little ammonia to the solution decreased considerably the conduction resistance, but caused evolution of gas at the cathode during passage of the current, and the deposited metal to be soft and of a dark color.

Experiment 5.—.1 gramme of dark red mercurous oxide was mixed with 21·cc. of the liquid. With electrodes of sheet platinum, a small amount only of mercury was deposited by the current from six cells. No gas was evolved. With yellow mercurous oxide the results were similar.

Experiment 6.—.33 gramme of oxide of silver was added to about 20·cc. of the asparagine liquid; the latter became

* Read before the Birmingham Philosophical Society, Jan. 21, 1886.

feebly alkaline. With an anode of silver and a cathode of platinum, and a current of from one, two or four cells, good deposits of white reguline silver were obtained. No gas was set free.

Cyanide of silver was insoluble in a hot solution of asparagine.

The Improved Harrison Safety Boiler.

The steam boiler is so important a part of many electrical installations, especially in electric light and power stations, that a short description of one of the leading types of safety boilers will be acceptable to our readers. The accompanying illustrations represent the Harrison Safety Boiler, Fig. 1 being the complete boiler as usually set, and Fig. 2 a detail, showing the section and method of connection.

Briefly described, the boiler consists of a number of hollow spheres made of Bessemer metal, termed "units," each eight inches in diameter and five-sixteenths of an inch thick, connected by curved necks three and one-quarter inches in diameter; these are cast in two and four unit sections, with opposite lateral openings to each sphere.

The form of hollow spheres was adopted as combining the greatest strength with the greatest heating surface, and this steam generater in its smallest form may be considered as one of these spheres, having its opposite lateral openings closed by caps held in place by bolts.

These units have ground rebate faces so perfectly made on special machinery that when pressed together into slabs by the heavy bolts which pass through their centres, they make a perfect steam and water-tight joint, iron to iron, without the aid of any kind of packing whatever. The bolts being surrounded by water, as shown in Fig. 2, cannot become overheated.

A given number of slabs (practically complete boilers in themselves) necessary to form the required horse-power, are suspended in an inclined position, side by side, from an iron framework, and are joined at the extreme top and bottom by suitable connections, forming steam and water couplings or passages.

The whole structure is then surrounded by brick-work, forming the fire place and combustion chamber, and particular attention is called to the fact that all the steam and water-heating surface hangs within this chamber, which, in conjunction with the shape of the boiler, facilitates in an unusual degree the admixture and absorption of the hot gases, insures dry steam, and makes the whole surface effective.

For use in localities where the water is bad, sectional mud drums are provided, having connections to each slab and furnished with suitable hand-holes for cleaning, large blow-off attachments, etc. For general requirements, and when space will permit, the form of setting as shown in Fig. 1 is strictly adhered to, yet the construction of this boiler permits of its being built in various forms, so as to be set in special locations and limited space. It can be arranged to use any kind of fuel or to utilize the waste heat from puddling furnaces, muffles, etc., either by being set over the furnace or in the main flues.

For boilers of from five to thirty horse-powor, suitable for locations having limited height, and where great economy of space is desirable, the units are erected in a vertical position with water legs on each side of the grate, terminating in mud drums.

The drums are below the grate and extend through the front; hence the ends are always accessible, and it is a matter of but a few minutes to remove the caps and scrape out all sediment.

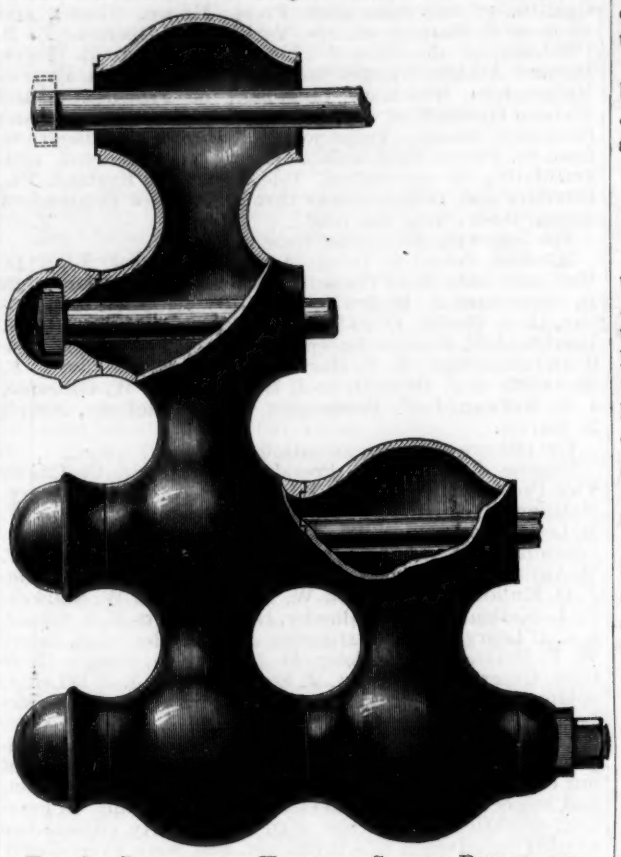


FIG. 2.—SECTIONS OF HARRISON SAFETY BOILER AND METHOD OF CONNECTING.

They are generally inclosed in brick-work, but to still further economize space, can also be inclosed by an iron shell having air space and fire-brick lining.

The Harrison Safety Portable Boiler consists of a number of the same units as are used in the stationary boilers, connected into one solid slab; this is supported on the two hollow feet, forming mud drums, which being below the grate, are always accessible and easily cleaned.

The construction also is such as to insure rapid steam-making and dry steam; and the accessibility of all parts permits of prompt and thorough inspection—a valuable trait in a boiler. The smallness of the individual parts also makes it especially easy of transportation and erection in locations inaccessible to some other forms of boilers.

At the International Electrical Exhibition held at Philadelphia in 1884, there was exhibited a battery of 200 horse-power of Harrison Safety Boilers, also a 30 horse-power vertical boiler, all of which were in constant use for supplying steam to the engines. In the test of the boilers at this exhibition, running for thirty-six hours consecutively, the Harrison Safety Boilers, while developing more than their rated power, evaporated 11.23 lbs. of water per pound of carbon from and at 212°—the highest of any boilers tested.

The manufacture of these boilers is actively carried on by the Harrison Safety Boiler Works, at Germantown Junction, Philadelphia, Pa., where their main office is also situated.

The Henry Electric Motor.

An exhibition of the Henry electric motor was given to the members of the press yesterday afternoon, says the *Kansas City Journal* of February 6th, on the fair ground tracks of the Fort Scott railway. Under the direction of Mr. Warren Watson, the party were driven to the plant, which is located near the Southwest Boulevard. Mr. Henry has constructed an engine house, in which he keeps his dynamos, and transmits the power from them to a telegraph line suspended along the side of the tracks, from which it is transmitted to his newly constructed excursion car, Pacinotti. The visiting party were invited aboard the car, and were soon spinning away at about eight miles an hour on a steep grade and around sharp curves. The trip was accomplished without any apparent difficulties. The return trip was made at an even greater rate of speed than the ascent, and all felt well pleased with the experiment. Mr. Henry says his invention does not infringe in any manner on other electric railways, and that the power can be transmitted either from above or below ground. A public test will be given in a few days, at which time the projectors of the new street railways are expected to be present and examine the invention. Mr. Henry has great hopes of having it introduced on some Kansas City street railway.

The "New American" Turbine.

The utilization of water powers where they are available is one of the most important factors in the economy of manufacturing, and much ingenuity has been spent in devising water wheels so that they shall extract the maximum of energy from the falling water. The old over and under shot water wheels may be said to be relics of the past, the turbine now being almost exclusively used in modern constructions, its many advantages being apparent.

Our illustrations represent a new and improved turbine recently brought out by Messrs. Stout, Mills & Temple, of Dayton, Ohio, and possessing several new features. Fig. 1 shows the turbine in perspective, and Fig. 2 the wheel. As will be noted, the latter is made in one casting, without a bolt or rivet, and hence possesses great strength, being able thus to withstand the pressure of large heads of water. The wheel is also formed so as not to be liable to clogging, and is designed to give maximum efficiency with every position of the gate.

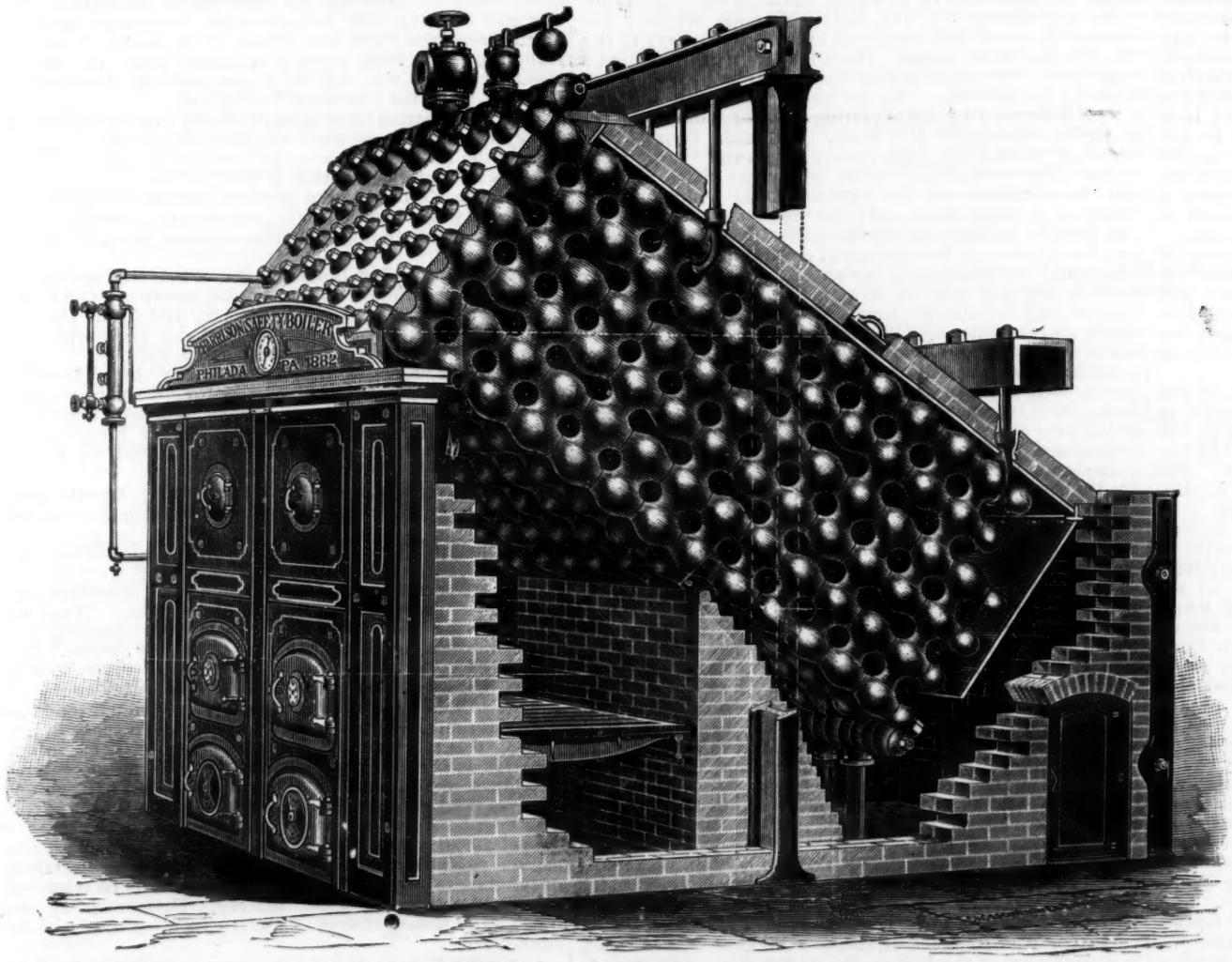


FIG. 1.—IMPROVED HARRISON SAFETY BOILER.

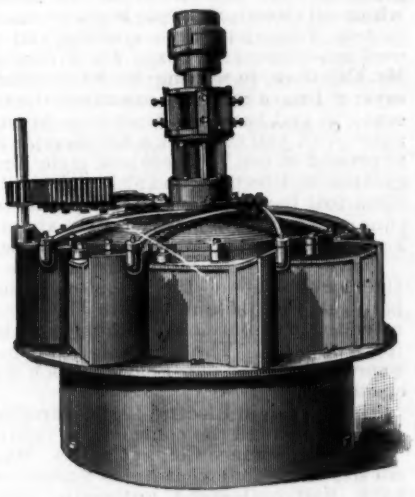


FIG. 1.

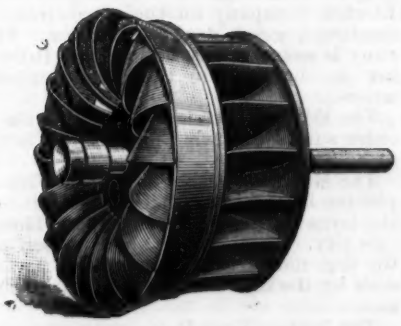


FIG. 2.

"NEW AMERICAN" TURBINE.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
NEW YORK, Feb. 22, 1886.

I notice the report in the papers that the electric steering gear on board the U. S. Steamer "Tallapoosa" has proved successful, which reminds me that Mr. Washburn, the inventor, is using an air compressor in connection therewith. This is but one of the many uses of air compressors in electrical applications, and if the subject were studied out, probably a still larger employment of them could be made.

Mr. M. B. Curtis, the active New York agent of the Thomson-Houston Company, informs me of the introduction of one of their new incandescent machines at Gloversville, this State, a bustling manufacturing town. The capacity of this machine is 150 lights. The local company was only started at the beginning of the year with a 45-light arc machine.

While on a recent round in Brooklyn, I visited the office of the United States Electrical Company, 286 Fulton street, where I was told that an ingenious belle of Brooklyn Heights, a student of electricity, has been furnishing her home throughout with a system of electric bells. One neat little contrivance of hers is a push button shaped like a toad's head, and carrying the jewel referred to by the poets. It is intended to be placed over a sofa or bed.

Mr. Edson, President of the Edson Recording and Alarm Gauge Company, 91 Liberty street, New York, has been touring through Philadelphia, Washington and the South for recreation, being in great need of rest and change. I hope to see him back in renewed strength and vigor, ready to meet the demand now growing so rapidly from electric lighting companies, etc., for the specialties made by his company.

I may mention here that Mr. A. F. Johnson, of Brooklyn, and his son, Mr. F. B. Johnson, now engaged with the above company, have produced a good many valuable electric novelties. W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
BOSTON, Feb. 22, 1886.

Before the end of the present week the Thomson-Houston Electric Company will move into new offices at No. 178 Devonshire street, and No. 33 Federal street, this city. The change of quarters gives the company more than four times larger space, and the offices are more roomy and commodious than those heretofore occupied. The fittings of the new offices will be very fine, and the entire quarters will be lighted by the company's system of arc and incandescent lighting.

The Electrical Development and Manufacturing Company are in receipt of some very flattering testimonials in regard to their new box. Among these are one from Superintendent Huntington, of the Baltimore & Ohio telegraph service, and one from Mr. Edward A. Callahan, whom all electrical people know as one of the earliest promoters of district service systems, and the one who first used messenger call boxes for giving automatic signals. Mr. Callahan, in writing to Superintendent Huntington, says: "I have carefully examined the call box which you sent me, and have no hesitation in stating that I fully agree with you that it is a far superior instrument to any at present in use." These new style boxes are giving the greatest satisfaction, and although the large factory of the Electrical Development and Manufacturing Company is running at full capacity, orders are on file sufficient to keep the present force at work for some weeks to come.

On the 8th of February was held the annual meeting of the stockholders of the Thomson-Houston Electric Company, at New Britain, Conn. The meeting was very well attended, and harmony, combined with general good feeling, prevailed. The greatest confidence and respect was expressed for the old Board, which was unanimously re-elected.

The Bernstein Electric Light Manufacturing Co., of this ity, has secured the contract for lighting the foundry of he Magee Furnace Co., at Chelsea, Mass. The plant will consist of incandescent lights exclusively, and will be run by a Ball high-speed automatic cut-off engine. The Bernstein Company has several other plants in this city which are giving thorough satisfaction. In addition to its lamps for the multiple arc system, this company is making a fine grade of lamps of nigh candle-power to run directly in series on arc light circuits. Some of these lamps are being used in the Rogers Building, on Washington street, by the Brush Electric Company on their arc circuit, and they are attracting a great deal of attention. The Bernstein Company is energetically and successfully but quietly pushing its business in the New England States and elsewhere.

The Edison Electric Illuminating Co. recently placed an order with the Jarvis Engineering Co. for a set of Sheffield grate bars.

The Martin-Wilson Automatic Fire-Alarm Company is placing its local closed circuit system and thermostats in the large establishment of Messrs. Houghton & Dutton, in this city. The fact has already been made manifest that the firm named will save several hundred dollars insurance by the introduction of the apparatus on their premises.

The Tarbox Time Register Company of this city reports a steadily increasing demand for the greatly improved Watchman's Electric Clock, which this concern is turning out in large quantities.

Business is very good with the New York Insulated Wire Co., 33 Oliver street, this city. The company reports the sale of its Grimshaw tape, both black and white, as rapidly increasing; to provide for which the facilities for manufacturing in large quantities are being increased.

The company is in receipt of a large number of letters from the trade, speaking in high praise of the excellent qualities of the tape, and expressing satisfaction with its simple yet thorough insulation of wire, and with the fact that the tape insulates the wire perfectly without the help of any other covering.

This company is also manufacturing a large amount of lead insulated wire in any lengths, without joints in the lead—no matter how long—and perfectly free from air holes.

Odd Fellows Hall, on last Friday night, was enlivened by the happiest and most enjoyable event of the season, it being the first ball of the Telegraphers' Mutual Aid and Literary Association. Nearly five hundred people were present, and among them were the following well-known telegraphers:

Superintendent C. J. Sheehan, Manager C. F. Hutchinson, Chief Operator C. E. Lyman, of the Baltimore & Ohio Telegraph Company; Superintendent D. J. Ham, Chief Operator F. Scott Smith, of the Mutual Union; Hon. J. E. Griffith, of the Associated Press; Messrs. Glassey and Thomas S. Murphy, of New York; Chief Operator E. B. Pillsbury, of the United Lines of this city; M. Hayes, Richard Ashley, Thomas Murphy, James Powers, Eugene McLaughlin, Miss Mary Linnehan, of Providence, and Richard Guilduff, of Pawtucket. The Boston Cadet band furnished music. Tufts was the caterer. Cablegrams from St. Pierre, Brest and Miquelon, were received, congratulating the association. Telegrams from Rutland, Vt., Duxbury and various towns throughout New England, of similar tenor, were also read.

The following gentlemen were in charge:

Marshal, Robert E. Tobin; Assistant Marshal, John D. Mullony; Aids, B. C. Chase, J. H. Burke, J. J. O'Leary, C. B. Parmenter, J. H. Irwin, W. M. Dwyer, J. A. McGlinchy, H. L. Kellen, O. F. Keating, W. H McCarty, H. N. Barrett, J. C. Bishop; Reception Committee, John M. Sullivan; Chairman, M. C. Harrington, W. A. Kenna, T. F. McAuliffe, J. J. Driscoll, G. J. McCarthy, H. W. Gillespie, J. R. McLean, J. P. Pendergast, M. W. McLean, Joseph R. Martin.

The officers of the organization are:

Eugene J. O'Connor, President; Benjamin C. Chase, Vice-President; George H. Winston, Recording Secretary; Matthew C. Harrington, Financial Secretary; Martin W. McLean, Treasurer; John J. O'Leary, Sergeant-at-Arms. Committee of Arrangements: Eugene J. O'Connor, T. F. McAuliffe, J. H. Burke, O. F. Keating, W. E. Henderson, J. D. Mullony, H. J. Hart, W. M. Dwyer, G. W. Starkey, H. L. Kellen, J. A. McGlinchy, H. N. Barrett, B. C. Chase, J. C. O'Leary, M. C. Harrington, J. B. Bowler, R. E. Tobin, W. F. McGrath, C. J. Foley, D. J. Donovan, Joseph Coulliard, George H. Winston, J. Stewart Carr, J. J. O'Leary, Seldon Crowe, J. M. Sullivan, C. B. Parmenter, M. W. McLean, J. R. McLean, G. J. McCarthy, J. H. Irwin.

The Exeter, N. H., *News*, of Feb. 12, says: Messrs. Frenyear & Razee courteously issued invitations to several of our citizens to visit their factory, last Saturday afternoon, and inspect Exeter's "first electric lighting plant" in practical operation. Together with about forty citizens we availed ourselves of this invitation, and were exceedingly pleased by what we saw of this new industry, coming away convinced that it will prove a most important addition to the business enterprises of Exeter. Since Messrs. Frenyear & Razee secured the Carman property, less than three months ago, the building has been entirely refitted, and, from its proximity to the railroad, is admirably adapted to its new uses. The entire building, two stories and a basement, is occupied by Messrs. Frenyear & Razee, and in our description of the works we will begin with the basement. An extension at one end serves as a boiler-room. The boiler in present use is soon to be replaced by a new and larger one. Power, both for manufacturing and lighting purposes, is furnished by a twenty horse-power engine specially manufactured by the Exeter Machine Works. The dynamo in use at this factory is of sufficient power to run 130 sixteen-candle lamps. There is also in the basement a forge and other conveniences for making needed tools and working up materials. At one end is parted off a room, which is devoted to nickel plating and the storage of the materials required for this work. The main floor is conveniently divided into offices, store rooms and a large work room. This work room is most admirably fitted out for the manufacture of the various goods which Messrs. Frenyear & Razee make. All the machinery is first-class and already includes an engine lathe, a screw machine, two hand lathes, a foot press and drilling machine. Four additional machines are at once to be put in. The upper floor is divided into an apartment for the storage of lumber, and a carpentry room The building is heated by steam and is electrically lighted throughout, the light having been used for the first time on Thursday of last week.

Messrs. Frenyear & Razee at present employ twenty-two hands, four of whom are women, but this number is likely to be much increased in the near future. The members of the firm are young and enterprising and thoroughly acquainted with their business, having long carried on a commission and manufacturing business in Boston. They are the patentees of the Frenyear luminous push buttons and control the Line luminous pendants, which have a steady and extensive sale. They make a specialty of the manufacture of electric bells of all varieties and of electric batteries, and, in fact, manufacture all variety of electric goods, and do an extensive business in other goods not of their own manufacture. They have already introduced their system of lighting at Park rink, and have contracts to introduce it elsewhere about town. Their location gives them a decided advantage over other manufacturers, who have to pay heavy rents in the cities. Already ranking fifth among our manufacturing establishments in the number of hands employed, and likely to grow to much greater importance, this new industry can hardly fail greatly to benefit the town, and our citizens should give it all the encouragement it is within their power to render.

Seth W. Fuller & Holtzer have removed to larger premises at 27 Arch street. W. I. B.

PROVIDENCE, Feb. 16, 1886.

The Narragansett Electric Light Company have extended their lines to Olneyville, and are supplying that lively town with divided arc lights over four miles of wire.

The contract for lighting the new Westminster museum (a counterpart of the Boston Bijou) has been awarded to the Rhode Island Electric Lighting Company, the plan including arc, incandescent and "Mogul" lights.

The lighting of the Silver Spring Bleaching and Dyeing Company with the Weston Mogul light is attracting much attention among mill owners, the new light having an especial fitness for manufacturing purposes on account of its simplicity and great brilliancy. This installation was made by the Rhode Island Electric Lighting Company.

The City Fathers are agitating the "underground question." A committee are to be sent to Chicago, New York and other places to examine the efforts in this direction. The recent mishaps by which the wires of the Narragansett Electric Light Company deranged the fire alarm system, probably prompted the move.

The Providence Electric Supply Company are introducing the "Eureka" open-circuit battery, a new and promising invention. It is sold under a guarantee of its good work, and they say at a much less price than any other battery in the market.

The Little Giant Battery, manufactured by the Rhode Island Telephone and Electric Co., of Providence, R. I., is rapidly growing in favor with all users of electric appliances. Its wonderful durability, strength and recovering properties are bound to make it one of the most universal batteries on the market. Among its many compliments received from various sources came to our hearing the following voluntary remarks from the proprietor of one of the favorite hotels at Long Branch: "On account of the Little Giant Battery placed in our hotel at the commencement of last season, our extensive electric appliances for the first time worked the entire season without attention. Examination at the close of the season proved that the batteries were still excellent, and, as their name indicates, were really little giants." To meet the constant and growing demand for this popular battery and other appliances the Rhode Island Telephone and Electric Co. have recently enlarged their facilities of manufacture. W. I. B.

PHILADELPHIA NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
PHILADELPHIA, Feb. 22, 1886.

The Belgian Consul at this city announces that His Majesty the King of Belgium has offered a prize of 25,000 francs, to be given in 1889 to the author of the best work upon "the progress of electricity used as a motor and for lighting purposes, with all the applications that can be made of it for such purposes, and the economical advantages which their use may offer." All foreigners desirous of competing for the prize will be required to send their works, printed or in manuscript, before January 1, 1889, to the Minister of Agriculture, Industry and Public Works, Brussels. A new edition of a printed work will be accepted if it presents many new ideas and features not embraced in the previous edition, and the date of its publication be not earlier than 1885. The competing work may be written in either French, German, Flemish, English, Spanish, or Italian, and, if in manuscript, will be required to be published the year following the awarding of the prize. The decision will be given by a jury of seven members, appointed by His Majesty, and composed of three Belgians and four foreigners of different nationality.

In his recent lecture on Historical Electrical Apparatus, before the Franklin Institute, Chief Examiner Kintner, of the Electrical Department in the Patent Office at Washington, says the first electrical patent was granted to D. Harrington, a Philadelphian, in 1833, and that prior to 1881 there was no separate class for electrical patents. In that year it was made a separate class. The lecturer gave praise to the workmanship exhibited in models filed for patents.

At the monthly meeting of the Franklin Institute, last Thursday, the newly-elected President, Col. Chas. H. Banes, presided, and read a paper on "The Institute in its relations to the progress of the mechanic arts in Philadelphia." The speaker called attention to the fact that from the time of its organization the Institute has done all in its power to promote the mechanical interests of the city and country. He suggested an "endowed chair of original research," and stated that, while the late Novelties Exhibition had been, from a scientific point of view, a great success, it was not so financially—in this respect differing from the Electrical Exhibition.

The underground fever seems to have attacked the New Jersey Legislature, as there was recently introduced a bill compelling all companies to put their wires under ground in cities having a population of 25,000 or over.

The learner's instrument recently put on the market by the Novelty Electric Company, of this city, contains many features recommending it to those contemplating the study of telegraphy.

The Harrison Safety Boiler Works, of this city, are having an increased sale for their boilers, many of which are being used by electric light people, and from the encomiums given them by the Electrical Exhibition examiners, they deserve a large sale in this field.

The Partz Electric Battery Company have recently begun the manufacture of batteries for all purposes, and, judging from the facilities they have, will meet success.

H. A. Cleverly, Treasurer of the Cleverly Electric Co., made a trip to Baltimore and Washington last week, and reports good trade with his specialities.

J. E. Lonergan, the oil-cup manufacturer, reports trade as good among electric light companies for his special dynamo cup.

The Electro Dynamic Company, of Philadelphia, the works and office of which, on Carter's Alley, were burned out recently, are again in the field and displaying an amount of energy that is truly Phœnix-like. They are now showing a double induction motor for running sewing machines, and which weighs only forty ounces. The motor is 4 inches long (not including the shaft) and 2¼ inches diameter. They claim that it is the only engine in the world that can lift 2,000 times its own weight one foot in one minute. More than $100,000 has been spent in perfecting this machine and in special tools for its manufacture. It is admirably adapted to the driving of sewing machines, dental and surgical tools, exhaust fans and blowers and all purposes requiring light electric power. The firm have also a cheap boat attachment which will propel a boat at the rate of four miles an hour. They also show a patent automatic battery that generates electricity only when in use, gives no shock and emits no odor. It is a form of the bichromate battery. This company also owns the "Edco" system of electric lighting—arc and incandescent.

Gillender & Sons, the large glass manufacturers, have recently added the making of glass for electrical purposes. E. F. I.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
CHICAGO, Feb. 20, 1886.

I regret to be obliged to chronicle the death of Mr. William Sidney Smoot, president of the Western Electric Company, who expired Thursday morning, the 18th inst., at his residence in Evanston, aged forty years. He was the son of Admiral Smoot, of the United States navy. At the age of eighteen he was transferred from a captaincy in the volunteer service to the Ordnance Corps of the regular army, with the rank of lieutenant, and was stationed during the latter part of the war at the United States Armory, in Springfield, Mass. While there he was the author of a small work on ordnance. Resigning from the regular army, he was for several years superintendent

of the Remington Armory, of Ilion, N. Y. He next took considerable interest in stock-raising in Montana, where he had a large ranch. A little over a year ago, on the resignation of General Anson Stager, he was elected president of the Western Electric Company, and took up his residence in Evanston, where he leaves a young wife and seven children. His mother, over eighty years of age, is still living in Washington.

Last week a bill was introduced in the Kansas Legislature making the rate for all telephones three dollars per month throughout the State, and where one party uses two or more sets, the rate to be two dollars and fifty cents for each set. Another section provides that the toll rate be fifteen cents for the first five minutes, and five cents for each additional five minutes' use.

The Kansas City Exchange reports a net gain of fifty-nine subscribers during the month of January—the largest monthly increase yet reported.

On account of legislation, the annual statements of the Missouri & Kansas Telephone Company and the United Telephone Company were delayed.

Arguments on the motions to dissolve the injunctions in the suits of "Diamond Joe" Reynolds, Robert Bines, and Frederick W. Story against Charles Whitlock, John C. and Thomas B. Gault, and R. M. Luton & Co., were heard by Judge Moran in this city on Friday, the 19th. The defendants were charged with selling a large amount of stock in the Inter-State telephone and telegraph company to the plaintiffs on false representations. The motions were continued to March 16, and the injunction bonds in the original suits were also increased from $1,000 to $5,000.

A. C. Knapp, a former stockholder in the company, files a cross-bill against Whitlock, Reynolds, Bines, the Gaults, and others, praying an injunction to restrain interference with the 700 shares of stock in dispute. Knapp had 750 shares, which he sold for $15 a share to Whitlock, to be sold to the Gaults and Luton, who sold them to Bines and Reynolds for $50 a share. He now asks a decree for the difference between $15 and $50 a share, amounting to $24,500.

I notice with pleasure that the next electric light convention is to be held in the West.

The Western Electric Company have just sold a 25-light electric light machine, to go to Michigan. W. A. K.

CLEVELAND, O., Feb. 21, 1886.

A. B. Lyman has recently bought out his partner, H. L. Shroudoffer, and is now running the business himself. He has enlarged his establishment and is now getting out some new instruments, in addition to making a specialty of electrical supplies.

There are now four, instead of two, electric lighting companies here, the Brush Electric Company and the Brush Electric Light and Power Company, both using the Brush system; the Cleveland Electric Light Company, using the Thomson-Houston, and the Forest City Electric Light Company, using the Mather system. That is all, I believe, for the present. The Forest City Electric Company have removed to 26 South Water street, where they are actively occupied in lighting, although hitherto they had been mainly devoted to electric and telegraphic supplies. Their system—the Mather incandescent—appears to be well liked. They have now a larger shop and office, giving them about three times as much room as formerly.

W. B. Cleveland's electric light cut-out is being used a great deal in this city.

The Forest City Carbon Company are now running full time.

The Cleveland telephone exchange has run up to between 1,750 and 1,775 subscribers.

BLOOMINGTON, Ill., Feb. 17, 1886.

The Central Union Company have moved their office into more spacious quarters and have rebuilt some of the works. They have put in new switchboards, have strung over a thousand feet of lead-covered cable, doing away with the tower altogether, and using a patent cross-box or exchange board, the invention of Asst. Gen'l. Supt. C. H. Wilson & Bro. They have also taken all wires off the buildings, and have in many respects improved the exchange and circuits.

The Thomson-Houston Company have 145 lamps lighting the streets here, and giving general satisfaction.

THE TELEGRAPH.

T. M. B. A.—J. P. Meder, care Virginia & Truckee Railway, Carson, Nev., has been appointed agent for this association vice F. H. Macdonell, Reno, resigned.

Postal Telegraphs.—The House Committee on Post Offices and Post Roads has unanimously agreed to report adversely all bills before it for the purchase or construction of telegraph lines by the Government. On Wednesday and Thursday, March 3 and 4, the committee will hear arguments from all persons who desire to address the committee on the subject of Government contracts with telegraph companies.

Western Union Dividend.—Rumors are published that the next Western Union dividend will be reduced to 1 per cent. They have been floating about the street for a week. The subject has not been discussed by the directors, for the meeting to consider the dividend is yet a month off. One or two speculative directors openly talk bearish on the stock, and there have been plain indications of inside selling. Other directors declare that so far in the current quarter the earnings have been fully equal to those of last year.

The Westbrook Duplex.—A dispatch of Feb. 8 from Harrisburg, Pa., says: Cherrick Westbrook, Sr., of this city, now in his seventieth year, patented a duplex instrument for receiving and transmitting messages by wire fourteen years ago, and declined all offers to sell it until recently, when manager Phillips, of the United Press Association, opened negotiations with him, and an agreement was reached by which Mr. Phillips secured control of the patent. The invention is said to be a great improvement over the instruments now in use and, it is thought, will put rival companies on a footing to compete advantageously with the Western Union monopoly.

A Broken Shore Cable.—The Western Union Telegraph people were notified recently of the breaking of the line of the Direct Cable Company between Rye Beach and Torbay, N. S. Mr. Roche, the Western Union manager, was asked for the use of a land wire from Rye overland to Nova Scotia, and promptly furnished it, so that the business of the cable company went on without interruption. The cable has an advantage over the land wires in the fact that it is not affected by storms. The land wires, between the icicles and the wind, were pretty generally down, but they are at present in good working order. The break in the cable is supposed to be somewhere on the banks, and is probably caused, as usual, by the anchor of some fishing vessel catching in it. It may be a week or more before it is repaired. Tests are already being made to determine where the break is, but the vessel of the cable company can only make the repairs in good weather, and a rough sea might postpone the work for some time.

THE TELEPHONE.

Underground in Chicago.—The Standard Underground Company have supplied another 100 miles of their make to the Chicago Telephone Company, who now will have 310 miles of it in use.

Erie, Pa.—The telephone exchange at Erie, Pa., has since January, 1884, increased from 174 subscribers to 427. The city has a population of 35,000. Every village in Erie County, with one or two exceptions, has been connected with the central office in Erie. The office system of the Brooklyn exchange has been adopted. The lines reach a total length of over 200 miles, of which 170 miles have been built in the last two years.

Cheap Telephone Service in Indiana.—The Supreme Court of Indiana on Feb. 20 affirmed the decision of the Marion County Criminal Court in the case of the State against John E. Hocket, the issues involved relating to the law reducing the rentals of telephones in the State from $5 to $3 a month, with a corresponding reduction for services to other towns. The decision is that the law is constitutional, and that the extra charges above $3 a month made by the company for alleged service, etc., are illegal, as by the word "telephone" the law meant all the appliances in connection with the service.

The Telephone Suits.—The Washington *Post* says that it is understood that the telephone suits will be brought to trial in Columbus, Ohio, before a jury. Judge Thurman, who will be the senior counsel in the case, and was given the power to make the selection, is said to favor Columbus. Washington was discussed for some time, but the denouncement of District of Columbia juries by Attorney-General Brewster in the star route cases and the other damaging statements which have been made in regard to the ease with which Washington juries could be influenced made it impossible for the government to select the capital city. Boston was rejected on account of the interest felt there in the success of the Bell Company, and a thoroughly neutral city had therefore to be chosen.

Department of Justice Expenditure—Representative Gibson, chairman of the House Committee on Expenditures in the Department of Justice, received replies from the Secretary of the Interior and the Attorney-General to the resolution of the committee asking what money had been expended by their departments in the Pan-Electric and Bell Telephone case. The reply of the Secretary of the Interior says $35 for printing, etc., was the only money expended in his department. The Attorney-general says no money has been expended in his department, but that counsel have been retained for the prosecution of the government suit. No money has yet been paid these counsel. Their names have already been made public. The resolution under which the committee is acting simply directs it to find what moneys have been expended by the government in the telephone cases.

THE ELECTRIC LIGHT.

St. Augustine, Fla.—The St. Augustine Gas and Electric Light Company has started up and is said to be in good shape for business.

Sandusky, O.—The Sandusky Electric Light, Fuel, Gas and Supply Company, of Sandusky, O., has just been organized by Watson Hubbard, Jay O. Moss and others.

Valparaiso, Chili.—It is announced that the firm of Grace & Co. has distributed a prospectus in regard to the formation of a company, with a capital of $100,000, to light Valparaiso by electricity on the Edison system.

N. E. L. A.—A passage in our report last week of the meeting of the National Electric Light Association, appears open to misconception in regard to the place of meeting in August. The letter read from Mr. Wm. F. Swift did not propose Cleveland, but withdrew it for Detroit for this time, on account of Mr. Fitzgerald putting in a plea for Cleveland later.

Shamokin, Pa—The controlling interest in the Shamokin Gas Light Company, of Shamokin, has been bought by the local electric lighting company. The original capital of the gas company was $25,000. This was raised, not long since, to $45,000. The system employed by the electric lighting company is the Edison. Shamokin is a flourishing and growing town, of over 14,000 inhabitants.

MISCELLANEOUS NOTES.

New England Weather.—According to official advices, the damages to lines by the recent bad weather has been greatly exaggerated.

Electric Steering Gear.—The U. S. steamer Tallapoosa arrived at Fortress Monroe on Feb. 19 from New York, after a successful test of the electric steering gear lately described in this paper.

The Jagel Electric and Pneumatic Subway Company has been incorporated to make and lay conduits or subways for telegraph, telephone, electric light, and other electrical conductors, and pneumatic tubes, car rails, sleepers, and tramways. Its incorporators are Julius M. Jagel, Charles G. Henning, Louis N. Jagel, and Julius C. Jagel, of Brooklyn, and William Welde, of this city. Its capital stock is $1,000,000, divided into 100,000 shares of $10 each.

The Patent Commissioner's Report.—In the annual report of Commissioner of Patents Montgomery the attention of Congress is directed to the fact that there is at present no statute empowering or directing the Attorney-General to institute proceedings in the name of the United States, or otherwise, to cancel or annul a patent which may have been fraudulently obtained or unwisely or inadvertently granted, and which may work great injury to the public. The total receipts of the office during the year were $1,188,089, and the expenditures were $1,024,379. The number of applications received were 35,717; the number of caveats filed was 2,552, and the number of issues was 25,691. Of the domestic patents issued, New York received the largest number, 4,532, or one patent to every 1,121 of her population; but Connecticut, with 1,011, had one patent to every 615 persons.

APPLICATIONS OF POWER.

An Electric Mountain Railway.—It is stated that a concession has been granted by the Swiss Government to a firm of electrical engineers at Geneva for making a railway up Mont Salène, near that place. The line will be made with a central rack very similar to that of the Righi line; the toothed pinion which works into it being driven by machinery.

Torpedoes Electrically Steered.—The Edison Machine Works, in this city, are now, it is said, building for the U. S. government a number of electrical torpedoes. These are propelled, steered and exploded from the shore by electricity. For the purpose of steering two powerful magnets are placed in the after part. When the torpedo is going straight ahead the rudder is held in the centre, but by the operator moving a small lever on shore the current passes from one magnet to the other, and the rudder is put over in the required direction. A speed at the rate of over 11 miles an hour has been reached on government tests, but it is expected that this will be exceeded. The charge consists of 400 pounds of dynamite. These torpedoes have been tested by being anchored in front of a fort and kept under a concentrated fire for hours, until the float has been completely riddled, and they have yet been ready for active service.

PERSONALS.

Mr. George A. Mayo, of the Narragansett Electric Light Company, Providence, and well-known in all New England electrical circles, has sustained a severe bereavement in the death of his only son, a bright little fellow nearly eight years old.

Miss Lulu Hurst, the electric girl, who made such a sensation North and West over a year ago, is now a student in Shorter Female College, at Rome, Ga. Miss Lulu was a poor country girl, who discovered by accident that she could tumble a man out of a chair by merely touching it. She made $100,000 by displaying her power, and is going to spend some of it for an education.

Mr. Charles S. Glover, Jr., who was formerly with the Edison Isolated Company for four years, has now been placed in charge of the wiring and dynamo setting of the Westinghouse Electric Light Company, Pittsburgh Division. He has already started a 150-light machine at Benwood, W. Va., and a 25-lighter at Altoona, Pa., and has just completed work on a 300-light plant at the paper mill of Morrison, Baer & Cais, Tyrone, Pa.

Mr. Edison.—Previous to leaving New York for Akron, O., for his marriage with Miss Miller, Mr. Edison gave a dinner at Delmonico's to some of his old friends and associates: E. H. Johnson, Charles Batchelor, S. Bergman, J. C. Tomlinson, C. E. Chinnock, Gardiner C. Sims, A. O. Tate, and Lieut. F. W. Toppan, U. S. N. They had a good time making speeches and wishing their old colleague luck, and then separated to meet at the wedding.

Col. Geo. L. Beetle.—A new and representative electrical office has been established in this city by the American Electrical Works of Providence, the proprietors of which had long had the matter of a New York branch office under contemplation, it being rendered highly desirable by the increasing demand for their products. They have now engaged Col. Geo. L. Beetle to represent them, a gentleman favorably known to the whole electrical community, and one whose activity cannot fail to keep the banner of the American Electrical Works waving in the front ranks.

Mr. E. C. Cockey.—It is understood that Mr. Edward C. Cockey, Chief of the Western Union Storage Department, at 195 Broadway, will now join to his duties those of Mr. Hunter, the storekeeper, who died so suddenly this month. Mr. Cockey is a well known man in the service. He has been President of the Telegraphers' Aid Society, and was at one time President of the Institute of Accountants and Book-keepers of this city. His service with the company dates back, we believe, to 1867, when he took charge of the accounts of the Eastern Division, though for a time he was associated with General Eckert in the Atlantic & Pacific Company. He was appointed to the Western Union Storage Department in 1881.

Alexander Graham Bell, who has been here for several days, says the New York *Tribune's* "Man About Town," has guarded his tongue carefully in the presence of newspaper men, but I heard him assert the other night with the utmost confidence that he has no more fear of the suit that has been ordered brought for the Government than he had of the result in the thousand and one suits that have already been decided in his favor in the courts. Mr. Bell's confidence is not shared by others in the Bell management. I was talking with one of his associates a short time ago, who said to me: "Up to the decision of Lamar, I thought there was no possibility of an adverse decision to our claims. It appears to me somewhat different now. The weight of the administration will be thrown to sustain Garland. If the final decision is against the Bell telephone, it would be a vindication of the administration. There is a conspiracy on foot to that end. The Southerners are all in it. The public, so the schemers think, will indorse the administration if it steals the Bell patents, because their annulment would result in cheapening telephone service. I am afraid the conspiracy is bigger than we had anticipated."

SPARKS AND FLASHES.

An Eye-Opener.—Professor Bell believes that some invention will soon be perfected to enable people to see by electricity. It is already accomplished. The Pan-Electric Company has opened a great many people's eyes.—*Pittsburgh Chronicle.*

Where Does the Property Owner Come In?—Street car companies only own the surface of such streets as they choose to occupy. Below the surface the gas and water works companies are sole proprietors. Above, the wire concerns—such as telegraph, telephone and electric companies—are supreme. Any other odd space that may happen to be about is used by the city for storing dirt.—*New Orleans Picayune,*

STOCK QUOTATIONS.

Telegraph, telephone and electric light quotations on the New York Stock Exchange, Boston Exchange and elsewhere are as follows:

Telegraph.—Western Union, b 72¼, a 72¾.

Telephone.—Am. Bell, b 152½, a 153; Erie, b 28½, Mexican, b 1½, a 1¾; New England, b 32, a 32¼; Tropical, b 1½.

Electric Light.—Edison stock is reported in very active demand at advancing rates.

BUSINESS NOTICES.

Volta-Pavia.—The advertisement on page iv. of last issue of the Chemical Electric Light and Power Company should have read "ten" instead of "two" cells.

Chas. A. Schieren & Co. have received the following:

BALTIMORE, Jan. 29, 1886.

Messrs. Towner, Landstreet, & Co., Baltimore, Md., agents for Chas. A. Schieren & Co., New York:

GENTLEMEN:—The 24 and 30-inch electric belts made with cable screws furnished us by you, are running to-day with the same correctness without stretch, as when first put up. The 30-inch belt drives all our machinery, the 24-inch belts are distributors, and all work beautifully. I can cheerfully recommend the electric to all who want a good reliable belt.

Yours truly,

E. W. DAVIS, General Superintendent,
U. S. Electric Power and Light Company.

Hill's Hair and Whisker Dye
Colors to any natural shade of black or brown; 50c.
PIKE'S TOOTHACHE DROPS will cure in one minute; 25c.
DEAN'S RHEUMATIC PILLS are a prompt, sure cure; 50c.
HALE'S HONEY, the great cough cure; 25c., 50c. and $1.
GLENN'S SULPHUR SOAP heals and beautifies the skin; 25c.
GERMAN CORN REMOVER kills corns and bunions; 25c.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED FEBRUARY 9, 1886.

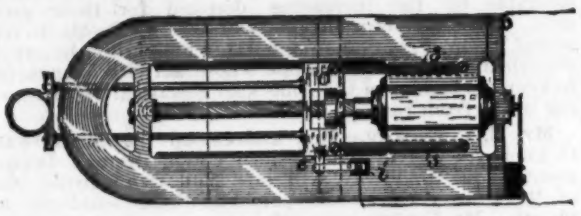
335,588. Telephone System; Charles A. Jackson, Lawrence, Mass., Assignor to David F Robinson, of same place. Consists of a dial, and indicator hand, a spur-wheel turning with the hand, longitudinally-movable rods for actuating and locking the wheel, and an electro-magnet for operating the rods, all constituting an individual call indicator, with electrical connections making circuit directly between the several subscribers' stations without the intervention of a central station, and apparatus at each subscriber's station simultaneously operated by the movement of the indicator-hand, and attached devices to give corresponding indications.

335,604. Call System; James C. McLaughlin, Cincinnati, O. Consists of a bell and push-button in each room, an office-box having an annunciator and key compartment for each room, each compartment having an adjustable name and time index, and a call-button and electric circuits between the rooms and office-box.

335,605. Circuit Closer; Andrew C. McNeal, Griegersville, Ky., Assignor of one-half to William H. Tyree, of same place. Consists in a secondary lever having a knob projecting through and above the key-button, which will be depressed to the level of the key-button when the latter is grasped by the fingers in the act of operating the key, so that the other end of the lever will be raised and break contact with the anvil, leaving the circuit free to be controlled by the key as long as it is being operated, and when released the lever will fall by gravity.

335,637, 335,638, 335,639. Electric Belts and Trusses; Andrew T. Sherwood, San Francisco, Cal. The first relates to a belt and consists of a clamp comprising a slide and groove and electric terminals, while the other two are provided with detachable truss pads adapted to be charged with electricity.

335,659. Dynamo Regulator; Charles J. Van Depoele, Chicago, Ill. The dispositions of the circuits and other elements of the invention are shown in the cut. The patent claims a separate helix supplementary to the main helix of the field-magnet, the separate helix being so wound and connected that the machine working normally will not be influenced thereby, but on the current becoming abnormally strong the supplementary helix will be brought into action and tend to diminish the magnetism of the field-magnet, and automatically regulate the strength thereof to accommodate the outside work.



335,693. ELECTRIC CALL GENERATOR.

335,681. Printing Telegraph; George A. Cardwell Brooklyn, N. Y., Assignor of two-thirds to Frederick K. Fitch, New York, N. Y., and Joseph T. Murray, Newark, N. J., said Murray Assignor of one-half of his right to William P. Arnold, Elizabeth, N. J. Consists of, first, receiving relays and printing circuit relays which partially complete the printing circuit under the action of the first electrical impulse of the sending key; second, a supplementary electro-magnetic device which temporarily maintains the preparatory closure or completion of said printing circuit; third, a series of circuits, batteries, and contacts, which, when two impulses are sent by the key, fully completes said printing circuit to the exclusion of all others.

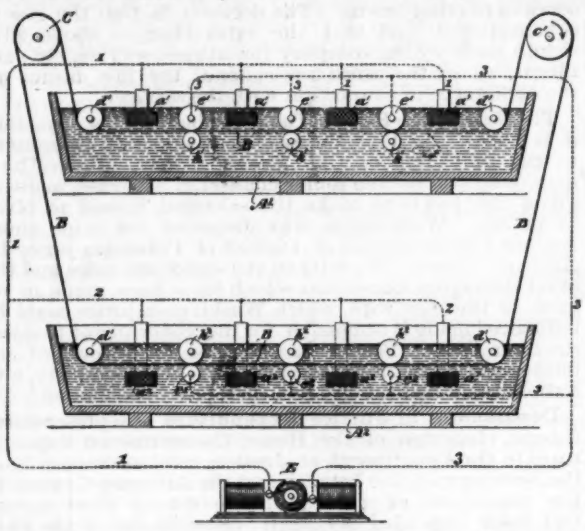
335,682. Printing Telegraphs; George A. Cardwell and Frederick K. Fitch, New York, N. Y. Consists in the provision of a key which will first make and break a preparatory circuit, then make the printing circuit, and finally resume its normal position without remaking the preparatory circuit.

335,687. Electric Meter; John I. Drake, Providence, R. I. Consists of a helix and weighted beam and a clock train or chronometer movement which imparts motion to a drum or cylinder carrying a suitably graduated or ruled paper, whereby a pencil connected and moving with the armature is made to record upon said graduated surface both the duration and force of the electric current, as well as indicating any changes or fluctuations therein.

335,693. Electric Call Generator; Ezra T. Gilliland, Boston, Mass. The dynamo, as shown in the cut, is adapted to rotate a predetermined number of times by a single movement.

335,701. District Telegraph Signal Box; Fred. A. Holcomb, Grand Rapids, Mich. It is provided with two safety plugs, one being permanently fixed to prevent backward motion of the handle and the other being removable and adjustable to different calls.

335,708. Telephone System; Thomas D. Lockwood, Malden, Mass. The principal claim is: A telephone-exchange system comprising a series of sub-stations, a central or connecting station, electric lines or circuits connecting the several sub-stations with the connecting-station, means, as indicated, comprising a rotatable cylindrical circuit-changer actuated by clockwork for each of the said lines, each circuit-changer being controlled by an electromagnet in its own line-circuit, and provided with a series of conducting-cams, a series of contact-springs, each constituting a portion of another line, and each placed within the reach of one of said cams, but beyond the reach of the others, an indicator at each sub-station adapted to rotate synchronously with

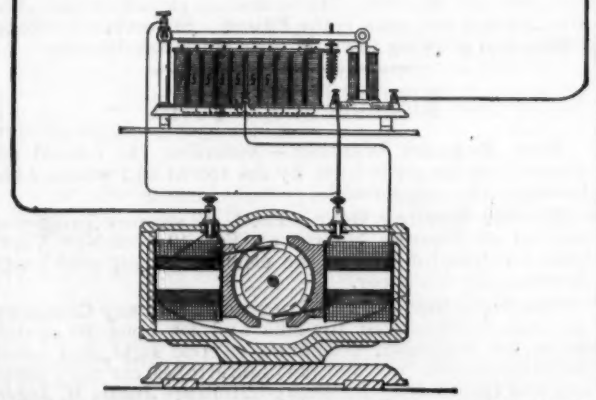


335,905. APPARATUS FOR FORMING SHEET METAL BY ELECTRO-DEPOSITION.

the cylindrical circuit-changer of its own line, and current-sending devices at each sub-station, whereby each sub-station is enabled to operate its own circuit-changer at the connecting-station, and thereby connect its own line with any other desired line by stopping the circuit-changer at the moment when a conducting-cam is in contact with the desired line-spring, and at the same time by means of the indicator be enabled to intelligently govern the movements of said circuit-changer.

335,781. Electro-Dynamic Motor; Frank J. Sprague, New York, N. Y. Consists of an electro-dynamic motor having a field-magnet whose main poles are formed by cores extending in opposite directions, having a set of shunt-coils wound evenly on all cores, and a set of series coils, also wound evenly thereon, the sets being arranged to form pole-lines at right angles to each other.

335,786, 335,787. Arc Lamp; Nikola Tesla, of Smiljau Lika, Austria-Hungary, Assignor to the Tesla Electric Light and Manufacturing Co. Rahway, N. J. The first consists of electro-magnets in the main and shunt circuits, an armature-lever and connection to the movable carbon-holder, the core of the shunt-magnet passing across the end of the armature-lever, so that the two magnets act in conjunction on the armature-lever in moving the carbon to form the arc and in opposition



335,659. REGULATOR FOR DYNAMO ELECTRIC MACHINES.

to each other beyond the normal position of the armature-lever. The second relates to details of construction embraced broadly by the first.

335,791. Telephone; Henry Alabaster and Tom Ernest Gatehouse, London, England. The electrodes in this telephone are polished so smoothly that the force of adhesion is strong enough to hold them together against the force of gravitation. The device itself consists of two electrodes of one polarity, upon which rests a third electrode of opposite polarity, all inclosed in such a manner that the former are fixed and the latter easily movable.

335,806. Telephone Transmitter; Warren P. Freeman, New York, N. Y., Assignor to Benj. S. Clark, of same place. Comprises an elastic cushion for the seat of the carbon electrode under the diaphragm-electrode, so as to produce a delicate and elastic adjustment, and consequently a better articulation.

335,831. Electric Lamps; Otto A. Moses, New York, N. Y. Consists in inserting the same in a glass tube, expelling a portion of the air therefrom by heating the tube and closing the glass about the wires while the tube is allowed to cool, thereby creating a partial vacuum within the tube while the wires are heated.

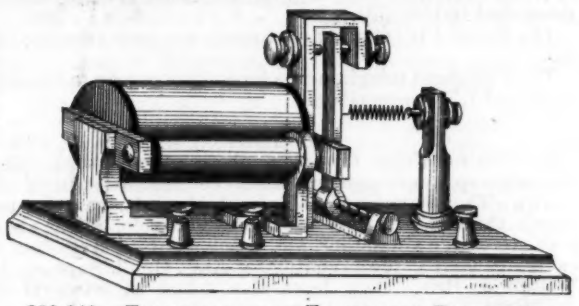
335,852. Electric Signal; Henry Thau, New York, N. Y. Consists of a rachet-wheel mounted on the same shaft with the break-wheel, and having deep notches corresponding in position with the beginning of every complete signal, the notches being of sufficient depth to admit of the turning therein of the point of the pawl engaging the rachet-wheel, and the pawl being arranged to engage the rachet-wheel and prevent retrograde movement of the break-wheel except at the beginning of every signal.

335,863. Electric Motor; Joseph Weis, Jersey City, N. J. Consists of numerous details of construction such as could be set forth only by numerous cuts. It relates especially to regulation by movement of brushes.

335,905. Forming Sheet Metal; Moses G. Farmer, New York, N. Y. As shown in the cut, he passes a continuous strip of metal, such as brass, as a cathode between rollers. The brass is subsequently dissolved, leaving the deposit in the form of sheet metal.

335,934. Telephone Signal; Warren S. Johnson, Whitewater, and Charles L. Fortier, Milwaukee, Wis. The generator is a dynamo which is operated by a push button in one direction and by compressed air in the other direction.

335,970. Gas Engine Igniter; Charles E. Skinner, Yonkers, N. Y. There is provided a crank vibrating on a stud and operated by a cam on the longitudinal shaft of the engine, whereby the electric current is furnished to each igniter successively.



336,040. TELEGRAPH AND TELEPHONE PROTECTOR.

335,998, 335,999, 336,000, 336,001, 336,002, 336,003. Electric Devices; Frank E. Fisher, Detroit, Mich.

1. Relates to a motor which consists of two field-magnets brought together upon interposed pieces of diamagnetic material and fastened by diamagnetic fastenings.

2. Relates to an electric bell, and consists of a permanent magnet of U form rigidly held in a surrounding frame of soft metal cast around the magnet, a vibrating armature pivoted between lugs formed on said frame, a helix of insulated wire wound upon said armature, and bells between which the end of the armature vibrates.

3. Comprises a dynamo, which is substantially the same as that used in the above bell patent.

4. Relates to minor details of an annunciator which is intended to operate by means of alternating currents.

5. Includes a telephone call system. Consists of the main line and local signaling-circuit, an electric motor, an indication-dial adapted to be moved by said motor, and devices carried by said dial for closing the signaling-circuit.

6. Relates to a push-button having a base, a raised centre, and encircled by a screw-threaded band of soft metal cast thereon, and having lugs formed in the casting, and a top having therein a screw-threaded ring of soft metal cast therein, and having lugs formed thereon in casting.

336,030. Apparatus for Treating Ores; Jacob C. Wiswell, Medford, Mass., Assignor to the Wiswell Electric Mining Machinery Co., Portland, Me. Consists in a machine for grinding and crushing ores, having a bed or surface for holding the ores and mercury, and crushing-rolls operating thereon, having suitable electrical connections, so that the electric current is continuous between the rolls and bed and through the ore and mercury, whereby the effect of the mercury is intensified, and the disintegration of the ore is facilitated.

336,040. Telegraph and Telephone Protector; Charles C. Drake, Trenton, N. J. Consists, as shown in the cut, of an electric circuit and electrical instruments included therein, through which a path of high resistance is always maintained; an automatic electro-magnetic device consisting of high and low resistance magnets, and connections constructed to automatically close a path of low resistance around said instruments when the current traversing the main line exceeds the normal amount.